



Weston Solutions, Inc.
Suite 201
1090 King Georges Post Road
Edison, New Jersey 08837-3703
732-585-4400 • Fax 732-225-7037
www.westonsolutions.com

201968



The Trusted Integrator for Sustainable Solutions

REMOVAL SUPPORT TEAM 2
EPA CONTRACT EP-W-06-072

December 4, 2009

Mr. Cris D'Onofrio, OSC
U.S. Environmental Protection Agency
Response and Prevention Branch
2890 Woodbridge Avenue
Edison, NJ 08837

EPA CONTRACT NO: EP-W-06-072

TDD NO: TO-0013-0129

DOCUMENT CONTROL NO: RST 2-02-F-1202

**SUBJECT: QUALITY ASSURANCE PROJECT PLAN – ALFRED HELLER HEAT
TREATING COMPANY STIE**

Dear Mr. D'Onofrio:

Enclosed please find the site revised Quality Assurance Project Plan (QAPP) for the Alfred Heller Heat Treating Company Site located at the 5 Wellington Street, Clifton, Passaic County, New Jersey.

If you have any questions, please do not hesitate to call me at (732) 585-4440.

Sincerely,

Weston Solutions, Inc.

Sayed Iqbal
Site Project Manager

Enclosure

cc: TDD File No. TO-0013-0129
S. Sumbaly, Chemist QA/QC Specialist



SITE QUALITY ASSURANCE PROJECT PLAN

**Alfred Heller Heat Treating Company Site
Clifton, Passaic County, New Jersey**

Prepared by:

Removal Support Team 2
Weston Solutions, Inc.
Federal Programs Division
Edison, New Jersey 08837

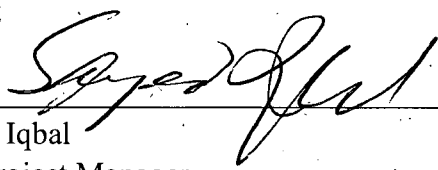
Prepared for:

U.S. Environmental Protection Agency
Response and Prevention Branch
Edison, New Jersey 08837

DCN #: RST 2-02-F-1202
TDD #: TO-0013-0129
EPA Contract No.: EP-W-06-072

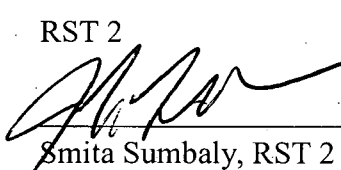
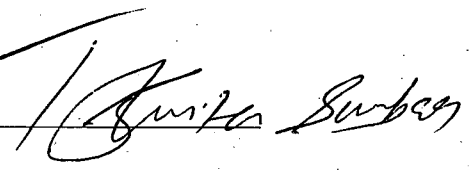
Approved by:

RST 2


Sayed Iqbal
Site Project Manager


Date: 12/4/09

RST 2

 
Smita Sumbaly, RST 2
Chemist QA/QC Specialist

Date: 12/4/09 1/21/10

EPA


Cris D'Onofrio
On-Scene Coordinator

Date: _____

TABLE OF CONTENTS

Section	Page
1 INTRODUCTION.....	1
2 PROJECT DESCRIPTION	1
3 PROJECT ORGANIZATION AND RESPONSIBILITIES	1
4 DATA USE OBJECTIVES, QA OBJECTIVES.....	2
4.1 DATA QA OBJECTIVES	3
4.2 QA OBJECTIVES	3
5 APPROACH AND SAMPLING PROCEDURES	9
5.1 SAMPLING DESIGN	9
5.2 SCHEDULE OF ACTIVITIES.....	10
5.3 SAMPLING EQUIPMENT.....	10
5.4 SAMPLE IDENTIFICATION SYSTEM.....	11
5.5 STANDARD OPERATING PROCEDURES (SOPs)	11
5.5.1 Sample Documentation.....	11
5.5.2 Sampling SOPs	12
5.5.3 Sample Handling and Shipment.....	13
5.6 SAMPLE CONTAINERS	13
5.7 DISPOSAL OF PPE AND CONTAMINATED SAMPLING MATERIALS.....	14
6 SAMPLE CUSTODY	14
7 FIELD INSTRUMENT CALIBRATION AND PREVENTIVE MAINTENANCE.....	14
8 ANALYTICAL METHODS	15
9 DATA REDUCTION, VALIDATION, AND REPORTING.....	15
9.1 DELIVERABLES.....	15
9.2 DATA VALIDATION.....	16
10 FIELD QUALITY CONTROL CHECKS AND FREQUENCY.....	16
11 SYSTEM AUDITS	17
12 CORRECTIVE ACTION	17

TABLE OF CONTENTS

(Continued)

The following elements are provided in the RST 2 Generic Quality Assurance Project Plan (QAPP) and are included by reference:

QA REPORTS TO MANAGEMENT

PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

RECORDS MANAGEMENT SYSTEM

LOGBOOK PROGRAM

QUALITY-RELATED DOCUMENTS

INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

LIST OF ATTACHMENTS

ATTACHMENT A: Site Location Map

ATTACHMENT B: Sampling SOPs

EPA/ERT SOP # 2001 – General Field Sampling Guidelines

EPA/ERT SOP # 2012 – Soil Sampling

EPA/ERT SOP # 2006 – Sampling Equipment Decontamination

EPA/ERT SOP # 1704 – Summa Canister Sampling

EPA/ERT SOP # 2082 – Construction and Installation of Permanent Sub-Slab Soil Gas Wells

1. INTRODUCTION

Presented herein is the Site Quality Assurance Project Plan (QAPP) for the sampling event to be conducted at the Alfred Heller Heat Treating Company Site by the Region II Removal Support Team 2 (RST 2). The site QAPP has been developed at the request of the U.S. Environmental Protection Agency (EPA) in accordance with the RST 2 generic QAPP.

This plan is based on information currently available and may be modified on-site in light of field screening results and other acquired information. All deviations from the QAPP will be noted in the Sampling Trip Report.

2. PROJECT DESCRIPTION

The Alfred Heller Heat Treating Company is a former heat treating and zinc plating/conversion coating facility located at 5 Wellington Street, Clifton, NJ. The Site is located in a densely populated area of Clifton, consisting of a mix of residential and light industry.

The Site is approximately four acres in size and contains six contiguous buildings with an approximate floor space of 75,000 square feet. The buildings contained two zinc electroplating lines, one zinc phosphate conversion coating line, and approximately 30 heat treating furnaces of various sizes. Included in the heat treating furnaces were three austemper furnaces; two of which contained an approximate total of 170 tons of molten sodium nitrite/nitrate at the time of initiation of the Removal Action. Additionally three of the heat treating furnaces contained approximately 2,000 gallons each of halogen-containing quench oils. Approximately 30,000 gallons of waste oil were contained both in the furnace reservoirs and in totes which were stored within the buildings. Trichloroethylene was used as a degreaser for some metal parts until the company switched to n-propyl bromide in the 1990s.

The Site also consists of two laboratories which contained various laboratory chemical containers including acids, bases, solvents and other chemicals. Approximately 596 drums of waste and/or product have been identified on-site since initiation of the Removal Action. Additionally, there were seven above-ground storage tanks and two underground storage tanks (USTs) located on the property. Some of the above-ground storage tanks have been removed from the site.

Currently, EPA is in the process of conducting a Removal Action at the Site. Most of the wastes have been containerized for transportation and disposal.

3. PROJECT ORGANIZATION AND RESPONSIBILITIES

The EPA On-Scene Coordinator (OSC), Cris D'Onofrio, will provide overall direction to the staff concerning project sampling needs, objectives, and schedule. The Site Project Manager (SPM), Sayed Iqbal, will be the primary point of contact with the OSC. The SPM is responsible for the development and completion of the Sampling QA/QC Plan, project team organization,

and supervision of all project tasks, including reporting and deliverables. The Site QC Coordinator will be responsible for ensuring field adherence to the Sampling QA/QC Plan and recording of any deviations. The RST 2 Chemist QA/QC Specialist, Smita Sumbaly, will be the primary project team site contact with the subcontracted laboratory. Laboratory services will be procured by RST 2 if, Region 2 is unable to secure analytical services through the Region 2 DESA Laboratory, Contract Laboratory Program (CLP) or the region-specific analytical service (non –RAS) contract.

RST 2 will arrange for the laboratory analyses and transfer custody of the multi-media samples for shipment to the appropriate laboratory. The non-CLP laboratory provide data package to RST 2 for data validation. The samples analyzed by EPA's Contract Laboratory Program will be validated by EPA's Environmental Assistance Team (ESAT). RST 2 will receive the data for data management purposes and report preparation.

The following sampling personnel will work on this project:

<u>Personnel</u>	<u>Affiliation</u>	<u>Responsibility</u>
Cris D'Onofrio	US EPA	On-Scene Coordinator
Sayed Iqbal	RST 2	Site Project Manager, Field Coordinator, Health & Safety Coordinator, Site QA/QC
TBD	RST 2	Sample Collections and Management
TBD	RST 2	Sample Collections and Management
TBD	RST 2	Sample Collections and Management
Smita Sumbaly	RST 2	Laboratory Procurement

The following laboratories will provide the analyses indicated:

<u>Lab Name/Location</u>	<u>Sample Type</u>	<u>Parameters</u>
TBD	Air and Soil Gas	VOCs
	Soil	TCL VOCs, TCL SVOCs, PCBs, TAL Metals + Mercury, TPH, Cyanide, and Hexavalent Chromium

A turnaround time of 2 weeks verbal and 3 weeks written results has been requested by the OSC.

4. DATA USE OBJECTIVES, QA OBJECTIVES

In addition to the following, the data use objectives, QA objectives procedure will be conducted in accordance with Sections A7, B1, B3, and B4 of the Region II RST 2 QAPP.

The objective of this removal assessment is to confirm the presence or absence of hazardous chemicals. The background information indicates that there are suspected hazardous materials were stored and used within the buildings including the trichloroethylene was used as a degreaser for some metal parts at the site. The objective of the sampling event is to identify any areas of

concern. Data from this sampling event will be used to assess potential risk to human health and to the environment.

4.1 DATA QA OBJECTIVES

The overall quality assurance (QA) objective for chemical measurement data associated with this sampling event is to provide analytical results that are legally defensible in a court of law. The QA program will incorporate quality control (QC) procedures for field sampling, chain-of-custody, laboratory analyses, and reporting to ensure generation of sound analytical results.

The EPA On-Scene Coordinator (OSC) has specified a definitive data QA objective for all air, soil, and soil gas samples analytical parameters. Details of this QA level follow.

4.2 QA OBJECTIVES

As delineated in the *Uniform Federal Policy for Quality Assurance Project Plans, Part 2B: Quality Assurance/Quality Control Non-Time Critical QA/QC Activities*, the following requirements apply to the respective QA objectives and parameters identified.

The QA protocols for Screening Data, without confirmation have limited use, specifically for: Emergencies, Health and Safety screening using (e.g. Multi Rae, OVM, Jérôme Mercury...etc.). The Field Screening Data objective sampling events are applicable to all sample matrices and include:

1. Sample Documentation (location, date and time collected, batch, etc.)
2. Description of equipment and instrumentation
3. Sample documentation in the form of field logbooks, appropriate field data sheets, and chain-of-custody (when appropriate) records and procedures for field sampling management (e.g., sample location, transport, storage, sample collection methods and shipping procedure)
4. Calibration of all monitoring and/or field-portable analytical equipment prior to collection and analyses of samples with results and/or performance check procedures/methods summarized and documented in a field, personal, and/or instrument log notebook.
5. Analyte(s) identification
6. Field or laboratory determined method detection limits (MDLs) will be recorded along with corresponding analytical sample results, where appropriate.
7. Initial and continuous instrument calibration data.

For Screening Data with Definitive Confirmation Objective:

The QA protocols for a screening data with definitive confirmation QA objective sampling event are applicable to all sample matrices and include:

All QA requirements listed above and:

8. Analytical error determination (Measure the precision of the analytical method, replicate and standard laboratory QC parameters, method-specific requirements specified in the QAPP).
9. Definitive Confirmation (At least 10 percent of the screening data must be confirmed with definitive data)

For Definitive project:

The QA protocols for a definitive data QA objective sampling event are applicable to all sample matrices and include:

All QA levels requirements listed above and:

10. Collection and analysis of blind field duplicate sample
11. Field blanks (for dedicated and non-dedicated equipment), rinse blanks (for non-dedicated equipment), and
12. Matrix Spike/Matrix Spike Duplicate (MS/MSD) QC samples to provide a quantitative measure of the analytical precision and accuracy, as applicable.
13. Performance Testing sample (project specified) for this sampling event will not be collected.

Definitive identification - confirm the identification of analytes on 100% of the "critical" samples, via an EPA-approved method; provide documentation such as gas chromatograms, mass spectra, etc.

The objective of this project/event applies to the following parameters:

Table 1
Quality Assurance Objectives

QA Parameters	Matrix	Intended Use of Data	QA Objective
VOCs	Air	Determine the presence, absence and concentration of volatile organic compounds in the air	Definitive Data
VOCs	Soil Gas	Determine presence or absence of VOCs in the subsurface soils	Definitive Data
TCL VOCs, TCL SVOCs, TPH, PCBs, TAL Metals + Hg, Cyanide, Hexavalent Chromium	Soil	Assess potential human health and environmental impact	Definitive Data

A Field Sampling Summary is attached in Table 2 and a QA/QC Analysis and Objectives Summary is attached in Table 3. Subsection 5.1, Sampling Design, provides information on analyses to be performed on the individual samples

Table 2
Field Sampling Summary

Analytical Parameters	Matrix	Container Size	Preservative	Holding Time ¹	Subtotal Samples	Trip Blanks	Rinsate Blanks ²	Duplicate Samples	MS/MSD Samples ³	Total Field Samples						
VOCs	Air	1- 6 L Summa Canister	NR	30 days	2	NR	NR	1	NR	3						
VOCs	Soil Gas	1- 6 L Summa Canister	NR	30 days	6	NR	NR	1	NR	7						
TCL VOCs	Sub Slab Soil	3 – 5 g EnCore® 1 – 4 oz jar for percent moisture	Cool to 4 °C	48 hours,	28	NR	2	2	NR	32						
	Aqueous (RB)	3 – 40 ml glass vial	HCL, pH < 2	14 days to analysis if preserved 7 days to analysis if not preserved												
TCL SVOCs	Sub Slab Soil	1 – 8 oz glass jar	Cool to 4 °C	14 days to extraction, 40 days to analysis	28	NR	2	2	NR	32						
	Aqueous (RB)	2 – 1L amber glass bottles w/Teflon lined cap														
TPH – GRO	Sub Slab Soil	1 – 8 oz glass jar	Cool to 4 °C	14 days to analysis	28	NR	2	2	2	32						
	Aqueous (RB)	1 -1L amber glass bottles w/Teflon lined cap	Cool to 4 °C HCL, pH < 2													
TPH – DRO and ORO (C ₁₀ – C ₃₄)	Sub Slab Soil	1 – 8 oz glass jar	Cool to 4 °C	14 days to extraction, 40 days to analysis							28	NR	2	2	2	32
	Aqueous (RB)	1 -1L amber glass bottles w/Teflon lined cap	Cool to 4 °C HCL, pH < 2													

Table 2
Field Sampling Summary (Continue)

Analytical Parameters	Matrix	Container Size	Preservative	Holding Time ¹	Subtotal Samples	Trip Blanks	Rinsate Blanks ²	Duplicate Samples	MS/MSD Samples ³	Total Field Samples
TAL Metals + Hg and Total Cyanide	Sub Slab Soil	1 – 8 oz glass jar	Cool to 4 °C	Metals 6 months, 28 days for Hg and 14 days for Cyanide	28	NR	2	2	2	32
	Aqueous (RB)	1 - 1L plastic bottle for Cyanide	Cool to 4 °C NaOH, pH > 12.5							
		1 - 1L plastic bottle for TAL Metals and Hg	Cool to 4 °C HNO ₃ , pH < 2							
PCBs	Sub Slab Soil	1 – 8 oz glass jar	Cool to 4 °C	7 days to extraction, 40 days to analysis	28	NR	2	2	2	32
	Aqueous (RB)	1 - 1L amber glass bottles w/Teflon lined cap								
Hexavalent Chromium	Sub Slab Soil	1 – 8 oz glass jar	Cool to 4 °C	28 days to analysis	3	NR	1	1	1	5
	Aqueous (RB)	1 - 1L plastic bottle		24 hours to analysis						

¹ Holding time from date of sampling.

² Only required if non-dedicated sampling equipment to be used. NR - not required.

³ For MS/MSD analysis, additional sample volume will be collected.

Refer to Attachment B for a list of EPA/ERT SOPs to be used.

Table 3
QA/QC Analysis and Objectives Summary

Analytical Parameters	Matrix	Analytical Method Reference	QA/QC Quantitation Limits	QA Objective
VOCs	Air/Soil Gas	EPA Method TO-15	As per method	Definitive Data
TCL VOCs	Soil and Aqueous (RB)	CLP SOW SOMO 1.2 or SW 846 Methods 8260B	As per method	Definitive Data
TCL SVOCs	Soil and Aqueous (RB)	CLP SOW SOMO 1.2 or SW 846 Methods 8270D	As per method	Definitive Data
TPH	Soil and Aqueous (RB)	SW 846 Method 8015C	As per method	Definitive Data
PCBs	Soil and Aqueous (RB)	CLP SOW SOMO 1.2 or SW 846 Method 8082A	As per method	Definitive Data
Total Cyanide	Soil and Aqueous (RB)	CLP SOW ILMO 5.4 or SW 846 Method 9012A	As per method	Definitive Data
TAL Metals and Mercury	Soil and Aqueous (RB)	CLP SOW ILMO 5.4 or SW 846 Method 6010B/7470A	As per method	Definitive Data
Hexavalent Chromium	Soil and Aqueous (RB)	SW 846 Method 7196A	As per method	Definitive Data

Note: CLP-format deliverables required for all data packages.

5. APPROACH AND SAMPLING PROCEDURES

In addition to the following, the approach and sampling procedures will be conducted in accordance with Sections B1 and B4 of the Region II RST 2 QAPP.

The following sampling activities will be conducted at the Alfred Heller Heat Treating Site:

- Air Sampling
- Soil Gas Sampling
- Soil Sampling

This sampling design is based on information currently available and may be modified on-site in light of field-screening results and other acquired information. All deviations from the sampling plan will be noted in the Sampling Trip Report.

5.1 SAMPLING DESIGN

A Field Sampling Summary is attached in Table 2 and a QA/QC Analysis and Objectives Summary is attached in Table 3. Table 3 provides information on analyses to be performed on the individual samples. The field program will include the collection of air samples from two locations, soil gas samples from up to six locations and sub-slab soil samples from up to 24 locations. The exact sample locations are to be specified by the OSC. The event will be divided into three separate mobilizations. The first two will include air and soil gas sampling events scheduled to be conducted during the week of December 7, 2009. The third mobilization will include a soil sampling event scheduled to be performed during the week of December 14, 2009. All sampling activities will be performed by the Region II RST 2, under the direction of the EPA OSC.

All concrete boring and cutting at the soil gas and soil sample locations will be performed by EPA's Emergency Rapid Response Services (ERRS) contractor under the guidance of the OSC.

Air and Soil Gas Sampling

Air samples will be collected from two locations, in the office area and by the former Degreaser in Building No. 1. Soil gas samples will be collected from six locations; one from the office area, four from the sides of the former degreaser and one from within Building No. 4.

Soil gas well installation will be conducted in accordance with the guidelines outlined in EPA/ERT Construction and Installation of Permanent Sub-slab Soil Gas Wells SOP #2082 (Attachment B). Pre-drilling of the sub-slab soil gas wells will be performed by EPA's ERRS contractor using an electric Hammer Drill or Rotary Hammer Drill. The soil gas well will be drilled through the slab and several inches (less than a foot) into the sub-slab material. Once drilling is completed, a dedicated stainless steel tube (typically 12") of 1/4" OD will be inserted onto the borehole and attached to the female connector of a Swagelok® nut. A small amount of modeling clay will be placed around the stainless steel tube and Swagelok® nut joint. After placing the completed probe into the borehole and flush with the surface of the slab, the space

between the probe and the outside of the concrete will be filled with anchoring cement mix and will be allowed to cure for 24-hours.

Air and soil gas samples will be collected using 6-liter Summa canisters with flow controllers adjusted to collect a sample over a 24-hour period. After the canister is collected, a data sheet(s) will be completed and a tag will be attached to the Summa canister.

Soil Sampling

Soil samples will be collected from twenty locations within the site buildings and from locations in the courtyard located between Building No. 1 and Building No. 5. The soil samples will be collected after any concrete is removed. Each soil sample will be collected at 6" intervals beneath the concrete slab. Sub-slab soil samples (0-6") will be collected using decontaminated stainless steel scoops and/or a decontaminated stainless steel core sampler. Volatile Organic Compound samples will be collected as grab samples using EnCore[®] sampling devices. Three EnCore[®] devices will be used at each location and will be collected first prior to the soil sample being transferred into aluminum pie pans for homogenization. Samples will then be homogenized and placed into glass jars. Rocks and other debris will be removed prior to placing the sample into the jars. The stainless steel augers, scoops and core sampler will be decontaminated prior to and between use by following the procedures outlined in Section 5.5.2. All samples will be labeled, cooled to 4°C and stored in plastic coolers for shipment.

5.2 SCHEDULE OF ACTIVITIES

Proposed Start Date	Activity	End Date
December 9, 2009	Air and Soil Gas	December 15, 2009
December 15, 2009	Soil	December 18, 2009

5.3 SAMPLING EQUIPMENT

Soil gas samples will be collected using a reusable stainless steel Summa canister, fitted with 24-hour passive flow controllers calibrated by the laboratory. Canisters will be purged, cleaned, and prepared for sampling by the laboratory in accordance with Section 8.4 of EPA Method TO-15.

Each sub slab surface soil sample will be collected using a decontaminated stainless steel scoop and/or stainless steel core sampler via the slam bar method and placed into dedicated aluminum pie pans. A decontaminated stainless steel auger may be used to advance a boring to depth as needed instead of using the core sampler. New acetate liners and catch baskets for each location will be used, and the steel core sampler tube and shoe will be decontaminated prior to each advance. All stainless steel sampling equipment will be decontaminated after use as specified in Section 5.5.2.

5.4 SAMPLE IDENTIFICATION SYSTEM

Each sample collected by Region II RST 2 will be designated by a code that will identify the site. The code will be a site-specific project tracking number. The code for the Alfred Heller Heat Treating Company site is AH. The media type will follow the numeric code. A hyphen will separate the site code and media type. Specific media types are as follows:

AA – Ambient Air Sample
SG – Soil Gas Sample
SS – Sub Slab Soil Sample

After the media type, the sequential sample numbers will be listed; sample numbers will be identified as to their location area on the site and/or the location on the x and y coordinates of the sampling grid. A duplicate sample will be identified in the same manner as other samples and will be distinguished and documented in the field logbook.

5.5 STANDARD OPERATING PROCEDURES (SOPs)

5.5.1 Sample Documentation

All sample documents will be completed legibly, in ink. Any corrections or revisions will be made by lining through the incorrect entry and by initialing the error.

Field Logbook

The field logbook is essentially a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed in the writer's absence. All entries will be dated and signed by the individuals making the entries, and should include (at a minimum) the following:

1. Site name and project number
2. Name(s) of personnel on-site
3. Dates and times of all entries (military time preferred)
4. Descriptions of all site activities, site entry and exit times
5. Noteworthy events and discussions
6. Weather conditions
7. Site observations
8. Sample and sample location identification and description*
9. Subcontractor information and names of on-site personnel
10. Date and time of sample collections, along with chain of custody information
11. Record of photographs
12. Site sketches

* The description of the sample location will be noted in such a manner as to allow the reader to reproduce the location in the field at a later date.

Sample Labels

Sample labels will clearly identify the particular sample, and should include the following:

1. Site/project number.
2. Sample identification number.
3. Sample collection date and time.
4. Designation of sample (grab or composite).
5. Sample preservation.
6. Analytical parameters.
7. Name of sampler.

Sample labels will be written in indelible ink and securely affixed to the sample container. Tie-on labels can be used if properly secured.

Custody Seals

Custody seals demonstrate that a sample container has not been tampered with or opened. The individual in possession of the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook.

5.5.2 Sampling SOPs

The following sampling EPA/Emergency Response Team (ERT) SOPs will be used for this project:

General Field Sampling Guidelines

All sampling activities will be conducted in accordance with guidelines outlined in EPA/ERT General Field Sampling Guidelines SOP #2001.

Soil Sampling

Soil sampling activities will be conducted in accordance with guidelines outlined in EPA/ERT Soil Sampling SOP #2012.

Air/Soil Gas Sampling

Air/Soil gas sampling activities will be conducted in accordance with guidelines outlined in EPA/ERT Summa Canister Sampling SOP #1704.

As per OSC's request the soil gas well installation and construction will be conducted in accordance with guidelines outlined in EPA/ERT Construction and Installation of Permanent Sub-Slab Soil Gas Wells SOP #2082.

Sampling Equipment Decontamination

Sampling equipment will be decontaminated in accordance with guidelines outlined in EPA/ERT Sampling Equipment Decontamination SOP #2006.

Decontamination of sampling equipment for soil pile sampling will be conducted as follows:

1. Alconox detergent and potable water scrub.
2. Potable water rinse.
3. Deionized water rinse.
4. 10% Nitric Acid rinse.
5. Deionized water rinse.
6. A hexane rinse (pesticide-grade or better).
7. Air dry (sufficient time will be allowed for the equipment to completely dry).
8. Wrap or cover exposed ends of sampling equipment with aluminum foil (shiny side out) for transport and handling.

Refer to Attachment B for all applicable EPA/ERT sampling SOPs

5.5.3 Sample Handling and Shipment

The tagged Summa canister will be shipped to laboratory for analysis along with the chain of custody records. The Summa canister sample will be labeled with the sample number, time and date of collection, and analyses requested.

All sample documents will be sealed in a plastic bag and included in the shipping box. The shipping box will be sealed shut and affixed on at least two sides with custody seals so that any sign of tampering is easily visible.

Each of the sample bottles will be sealed and labeled according to the following protocol. Caps will be secured with custody seals. Bottle labels will contain all required information including site/project code and sample number, time and date of collection, analyses requested, and preservative used. Sealed bottles will be placed in large metal or plastic coolers, and padded with an absorbent material such as plastic peanuts. All packaging will conform to IATA transportation regulations for overnight carriers.

All sample documents will be sealed in a plastic bag and affixed to the underside of each cooler lid. The lid will be sealed and affixed on at least two sides with custody seals so that any sign of tampering is easily visible.

5.6 SAMPLE CONTAINERS

All sample containers will meet the QA/QC specifications in OSWER Directive 9240.0-05A, "Specifications and Guidance for Contaminant Free Sample Containers."

5.7 DISPOSAL OF PPE AND CONTAMINATED SAMPLING MATERIALS

All used PPE and disposable sampling equipment will be disposed of off-site in appropriate trash receptacles. No equipment will be disposed of on-site.

6. SAMPLE CUSTODY

In addition to the following, the sample custody procedure will be conducted in accordance with Section B2 of the Region II RST 2 QAPP.

A chain-of-custody record will be maintained from the time the sample is taken to its final deposition. Every transfer of custody must be noted and signed for, and a copy of this record kept by each individual who has signed. When samples (or groups of samples) are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal.

Specific information regarding custody of the samples projected to be collected on the weekend will be noted in the field logbook.

The chain-of-custody record should include (at minimum) the following:

1. Sample identification number
2. Sample information
3. Sample location
4. Sample date
5. Name(s) and signature(s) of sampler(s)
6. Signature(s) of any individual(s) with custody of samples

A separate chain-of-custody form must accompany each cooler for each daily shipment. The chain-of-custody form must address all samples in that cooler, but not address samples in any other cooler. This practice maintains the chain-of-custody for all samples in case of mis-shipment.

7. FIELD INSTRUMENT CALIBRATION AND PREVENTIVE MAINTENANCE

In addition to the following, the field instrument and preventative maintenance procedure will be conducted in accordance with Section B5 of the Region II RST 2 QAPP.

The sampling team is responsible for ensuring that a calibration/maintenance log will be brought into the field and maintained for each measuring device. Each log will include at a minimum, where applicable:

- Name of device and/or instrument calibrated.
- Device/instrument serial and/or ID number.
- Frequency of calibration.
- Date of calibration.

- Results of calibration.
- Name of person performing the calibration.
- Identification of the calibrant.

Equipment to be used each day will be calibrated prior to the commencement of daily activities.

8. ANALYTICAL METHODS

Analytical methods to be utilized in the analyses of samples collected during this sampling event are detailed in Table 3.

9. DATA REDUCTION, VALIDATION, AND REPORTING

In addition to the following, the data reduction, validation, and reporting procedure will be conducted in accordance with Section D1 of the Region II RST 2 QAPP.

9.1 DELIVERABLES

The RST 2 SPM, Sayed Iqbal, will maintain contact with the EPA OSC, Cris D'Onofrio, to keep him informed about the technical and financial progress of this project. This communication will commence with the issuance of the work assignment and project scoping meeting. Activities under this project will be reported in status and trip reports and other deliverables (e.g., analytical reports, final reports) described herein. Activities will also be summarized in appropriate format for inclusion in monthly and annual reports.

The following deliverables will be provided under this project:

Trip Report

A trip report will be prepared to provide a detailed accounting of what occurred during each sampling mobilization. The trip report will be prepared within 2 weeks of the last day of each sampling mobilization. Information will be provided on time of major events, dates, and personnel on-site (including affiliations).

Maps/Figures

Maps depicting site layout, contaminant source areas, and sample locations will be included in the trip report, as appropriate.

Analytical Report

An analytical report will be prepared for samples analyzed under this plan. Information regarding the analytical methods or procedures employed, sample results, QA/QC results, chain-of-custody documentation, laboratory correspondence, and raw data will be provided within this deliverable.

Data Review

A review of the data generated under this plan will be undertaken. The assessment of data acceptability or usability will be provided separately, or as part of the analytical report.

9.2 DATA VALIDATION

Definitive data projects: The data generated under this QA/QC Sampling Plan will be evaluated according to guidance in the Uniform Federal Policy for Implementing Environmental Quality Systems: Evaluating, Assessing and Documenting Environmental Data Collection and Use Programs Part 1: UFP-QAPP (EPA-505-B-04-900A, March 2005); Part 2B: Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities (EPA-505-B-04-900B, March 2005); the CLP National Functional Guidelines for Organic and Inorganic Data Review and the Region 2 Data Validation SOPs.

Laboratory analytical results will be assessed by the data reviewer for compliance with required precision, accuracy, completeness, representativeness, and sensitivity.

10. FIELD QUALITY CONTROL CHECKS AND FREQUENCY

In addition to the following, the field quality control checks and frequency procedure will be conducted in accordance with Section B6 of the Region II RST 2 QAPP.

This section details the QA/QC requirements for field activities performed during the sampling effort.

QA/QC samples will include the collection of one field duplicate and one matrix spike/matrix spike duplicate (MS/MSD) sample for each matrix (soil) at a ratio of 1 per 20 samples. Extra sample volume will be submitted to allow the laboratory to perform matrix spike (MS) sample analysis. This analysis provides information about the effect of the sample matrix on digestion and measurement methodology. Field duplicate samples provide an indication of analytical variability and analytical error and will not be identified to the laboratory.

Field rinsate blanks will be collected when non-dedicated sampling equipment is used. A field rinsate blank will consist of distilled deionized (DI), demonstrated analyte-free water that has been poured over decontaminated sampling equipment. The field rinsate blank analytical results will be utilized in evaluation of potential cross-contamination resulting from inadequate decontamination only if non-dedicated sampling equipment is used. The frequency of field rinsate blank collection is one blank per decontamination event per type of equipment, not to exceed more than one per day. Blanks will be collected for all parameters of interest (excluding physical parameters) and shipped with the samples collected the same day. Field rinsate blanks will be collected by Region II RST 2.

Field rinsate blanks will be collected in accordance with the procedure listed below:

1. Decontaminate sampling equipment using the procedure specified in Subsection 5.5.2 of this plan.

2. Pour DI water over the sampling device and collect the rinsate in the appropriate sample containers.

One temperature blank sample will be included in each shipped cooler to verify that the samples were maintained at $4 \pm 2^{\circ}\text{C}$ from the time they were placed in the cooler to their arrival at the laboratory. The temperature blank will be prepared by filling a sample container with unpreserved potable or distilled water. The container will be labeled "Temperature Blank" and dated. The receiving laboratory will establish and record the temperature of the blank on the chain-of-custody form immediately upon receipt, prior to inventory and refrigeration.

11. SYSTEM AUDITS

In addition to the following, the system audit procedure will be conducted in accordance with Section C1 of the Region II RST 2 QAPP.

The Field QA/QC Officer will observe sampling operations and review subsequent analytical results to ensure compliance with the QA/QC requirements of the project/sampling event.

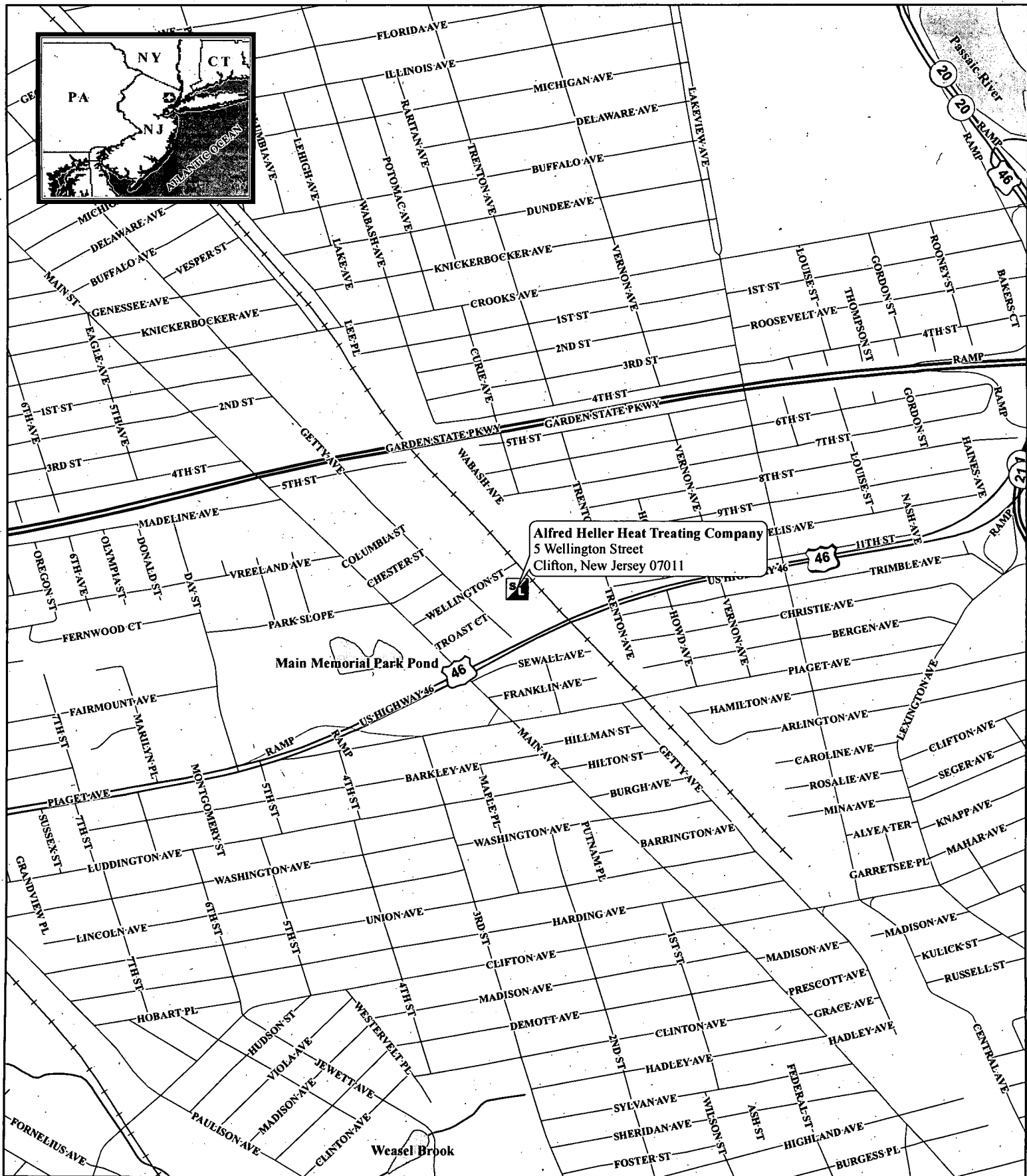
12. CORRECTIVE ACTION

In addition to the following, the corrective action procedure will be conducted in accordance with Section C1 of the Region II RST 2 QAPP.

All provisions will be taken in the field and laboratory to ensure that any problems that may develop will be dealt with as quickly as possible to ensure the continuity of the project/sampling events. Any deviations from this sampling plan will be noted in the final report.

ATTACHMENT A

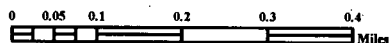
SITE MAP



Legend



Site Location



WESTON Weston Solutions, Inc.
 SOLUTIONS Northeast Division

In Association With
 Innovative Technical Solutions, Inc.,
 Scientific and Environmental Associates, Inc.
 and Avatar Environmental, LLC.

Figure 1:
Site Location Map

ALFRED HELLER HEAT TREATING SITE
 CLIFTON, NEW JERSEY

U.S. ENVIRONMENTAL PROTECTION AGENCY
 REMOVAL SUPPORT TEAM 2
 CONTRACT # EP-W-06-072

DATE MODIFIED: 11/23/2009
 QIS ANALYST: F CAMPBELL
 EPA OSC: C D'ONOFRIO
 RST SPM: S IQBAL
 FILENAME: SITEMAP.MXD

ATTACHMENT B

SAMPLING SOPS

STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 1 of 14
Rev. 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

CONTENTS

- 1.0 SCOPE AND APPLICATION
- 2.0 METHOD SUMMARY
- 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE
- 4.0 INTERFERENCES AND POTENTIAL PROBLEMS
- 5.0 EQUIPMENT/APPARATUS
- 6.0 REAGENTS
- 7.0 PROCEDURES
 - 7.1 Probe Assembly and Installation
 - 7.2 Sampling Set-Up
 - 7.3 Repairing a Loose Probe
- 8.0 CALCULATIONS
- 9.0 QUALITY ASSURANCE/QUALITY CONTROL
- 10.0 DATA VALIDATION
- 11.0 HEALTH AND SAFETY
- 12.0 REFERENCES
- 13.0 APPENDICES

STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 2 of 14
Rev. 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) outlines the procedure used for the construction and installation of permanent sub-slab soil gas wells. The wells are used to sample the gas contained in the interstitial spaces beneath the concrete floor slab of dwellings and other structures.

Soil gas monitoring provides a quick means of detecting volatile organic compounds (VOCs) in the soil subsurface. Using this method, underground VOC contamination can be identified and the source, extent and movement of pollutants can be traced.

2.0 METHOD SUMMARY

Using an electric Hammer Drill or Rotary Hammer, an inner or pilot hole is drilled into the concrete slab to a depth of approximately 2" with the $\frac{3}{8}$ " diameter drill bit. Using the pilot hole as the center, an outer hole is drilled to an approximate depth of 1 $\frac{3}{8}$ " using the 1" diameter drill bit. The 1" diameter drill bit is then replaced with the $\frac{3}{8}$ " drill bit. The pilot hole is drilled through the slab and several inches into the sub-slab material. Once drilling is completed, a stainless steel probe is assembled and inserted into the pre-drilled hole. The probe is mounted flush with the surrounding slab so it will not interfere with pedestrian or vehicular traffic and cemented into place. A length of Teflon® tubing is attached to the probe assembly and to a sample container or system.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

3.1 SUMMA® Canister Sampling

After the sub-slab soil gas sample is collected, the canister valve is closed, an identification tag is attached to the canister and the canister is transported to a laboratory under chain of custody for analysis. Upon receipt at the laboratory, the data documented on the canister tag is recorded. Sample holding times are compound dependent, but most VOCs can be recovered from the canister under normal conditions near the original concentration for up to 30 days. Refer to REAC SOP #1704, *SUMMA Canister Sampling* for more details.

3.2 Tedlar® Bag Sampling

Tedlar® bags most commonly used for sampling have a 1-liter volume capacity. After sampling, the Tedlar® bags are stored in either a clean cooler or an opaque plastic bag at ambient temperature to prevent photodegradation. It is essential that sample analysis be undertaken within 24 to 48 hours following sample collection since VOCs may escape or become altered. Refer to REAC SOP #2102, *Tedlar® Bag Sampling* for more details.

STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 3 of 14
Rev. 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The thickness of a concrete slab may vary from structure to structure. A structure may also have a single slab where the thickness varies. A slab may contain steel reinforcement (REBAR). Drill bits of various sizes and cutting ability will be required to penetrate slabs of varying thicknesses or those that are steel-reinforced.

5.0 EQUIPMENT/APPARATUS

- Hammer Drill or Rotary Hammer
- Alternating current (AC) extension cord
- AC generator, if AC power is not available on site
- Hammer or Rotary Hammer drill bit, 3/8" diameter
- Hammer or Rotary Hammer drill bit, 1" diameter
- Portable vacuum cleaner
- 1 - 3/4" open end wrench or 1-medium adjustable wrench
- 2 - 9/16" open end wrenches or 2-small adjustable wrenches
- Hex head wrench, 1/4"
- Tubing cutter
- Disposable cups, 5 ounce (oz)
- Disposable mixing device (i.e., popsicle stick, tongue depressor, etc.)
- Swagelok® SS-400-7-4 Female Connector, 1/4" National Pipe Thread (NPT) to 1/4" Swagelok® connector
- Swagelok® SS-400-1-4 Male Connector, 1/4"NPT to 1/4" Swagelok® connector
- 1/4" NPT flush mount hex socket plug, Teflon®-coated
- 1/4" outer diameter (OD) stainless steel tubing, pre-cleaned, instrument grade
- 1/4" OD Teflon® tubing
- Teflon® thread tape
- 1/8" OD stainless steel rod, 12" to 24" length
- Swagelok Tee, optional (SS-400-3-4TMT or SS-400-3-4TTM)

6.0 REAGENTS

- Tap water, for mixing anchoring cement
- Anchoring cement
- Modeling clay

STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 4 of 14
Rev. 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

7.0 PROCEDURES

7.1 Probe Assembly and Installation

1. Drill a $\frac{3}{8}$ " diameter inner or pilot hole to a depth of 2" (Figure 1, Appendix A).
2. Using the $\frac{3}{8}$ " pilot hole as your center, drill a 1" diameter outer hole to a depth of 1 $\frac{3}{8}$ ". Vacuum out any cuttings from the hole (Figure 2, Appendix A).
3. Continue drilling the $\frac{3}{8}$ " inner or pilot hole through the slab and a few inches into the sub-slab material (Figure 3, Appendix A). Vacuum out any cuttings from the outer hole.
4. Determine the length of stainless steel tubing required to reach from the bottom of the outer hole, through the slab and into the open cavity below the slab. To avoid obstruction of the probe tube, ensure that it does not contact the sub-slab material. Using a tube cutter, cut the tubing to the desired length.
5. Attach the measured length (typically 12") of $\frac{1}{4}$ " OD stainless tubing to the female connector (SS-400-7-4) with the Swagelok® nut. Tighten the nut.
6. Insert the $\frac{1}{4}$ " hex socket plug into the female connector. Tighten the plug. **Do not over tighten.** If excessive force is required to remove the plug during the sample set up phase, the probe may break loose from the anchoring cement.
7. Place a small amount of modeling clay around the stainless steel tubing adjacent to the Swagelok® nut, which connects the stainless steel tubing to the female connector. Use a sufficient amount of modeling clay so that the completed probe, when placed in the outer hole, will create a seal between the outer hole and the inner hole. The clay seal will prevent any anchoring cement from flowing into the inner hole during the final step of probe installation.
8. Place the completed probe into the outer hole. The probe tubing should not contact the sub-slab material and the top of the female connector should be flush with the surface of the slab and centered in the outer hole (Figure 4, Appendix A). If the top of the completed probe is not flush with the surface of the slab, due to the outer hole depth being greater than 1 $\frac{3}{8}$ ", additional modeling clay may be placed around the stainless steel tubing adjacent to the Swagelok® nut, which connects the stainless steel tubing to the female connector. Use a sufficient amount of clay to raise the probe until it is flush with the surface of the slab while ensuring that a portion of the clay will still contact and seal the inner hole.

STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 5 of 14
Rev. 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

9. Mix a small amount of the anchoring cement. Fill the space between the probe and the outside of the outer hole. Allow the cement to cure according to manufacturers instructions before sampling.

7.2 Sampling Set-Up

1. Wrap one layer of Teflon® thread tape onto the NPT end of the male connector (SS-400-1-4). Refer to Figure 5, Appendix A.
2. Remove the 1/4" hex socket plug from the female connector (SS-400-7-4). Refer to Section 7.3 if the probe breaks loose from the anchoring cement during this step.
3. To ensure that the well has not been blocked by the collapse of the inner hole below the end of the stainless steel tubing, a stainless steel rod, 1/8" diameter, may be passed through the female connector and the stainless steel tubing. The rod should pass freely to a depth greater than the length of the stainless steel tubing, indicating an open space or loosely packed soil below the end of the stainless steel tubing. Either condition should allow a soil gas sample to be collected.

If the well appears blocked, the stainless steel rod may be used as a ramrod in an attempt to open the well. If the well cannot be opened, the probe should be reinstalled or a new probe installed in an alternate location.

4. Screw and tighten the male connector (SS-400-1-4) into the female connector (SS-400-7-4). **Do not over tighten.** This may cause the probe to break loose from the anchoring cement during this step or when the male connector is removed upon completion of the sampling event. Refer to Section 7.3 if the probe breaks loose from the anchoring cement during this step.
5. If a collocated sub-slab sample or split sample is desired, a stainless steel Swagelok Tee (SS-400-3-4TMT or SS-400-3-4TTM) may be used in place of the Swagelok male connector (SS-400-1-4).
6. Attach a length of 1/4" OD Teflon® tubing to the male connector with a Swagelok® nut. The Teflon® tubing is then connected to the sampling container or system to be used for sample collection.
7. After sample collection remove the male connector from the probe and reinstall the hex socket plug. **Do not over tighten** the hex socket plug. If excessive force is required to remove the plug during the next sampling event the probe may break loose from the

STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 6 of 14
Rev. 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

anchoring cement. Refer to Section 7.3 if the probe breaks loose from the anchoring cement during this step.

7.3 Repairing a Loose Probe

1. If the probe breaks loose from the anchoring cement while removing or installing the hex head plug or the male connector (SS-400-1-4), lift the probe slightly above the surface of the concrete slab.
2. Hold the female connector (SS-400-7-4) with the $\frac{3}{4}$ " open end wrench.
3. Complete the step being taken during which the probe broke loose, following the instructions contained in this SOP (i.e., **Do not over tighten** the hex socket plug or male connector).
4. Push the probe back down into place and reapply the anchoring cement.
5. Modeling clay may be used as a temporary patch to effect a seal around the probe until the anchoring cement can be reapplied.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

An additional collocated soil gas well is installed with the frequency of 10 percent (%) or as specified in the site-specific Quality Assurance Project Plan (QAPP). The following general Quality Assurance (QA) procedures apply:

1. A rough sketch of the area is drawn where the ports are installed with the major areas noted on the sketch. This information may be transferred to graphing software for incorporation into the final deliverable.
2. A global positioning system (GPS) unit may be used to document coordinates outside of a structure as a reference point.
3. Equipment used for the installation of sampling ports should be cleaned by heating, inspected and tested prior to deployment.

STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 7 of 14
Rev. 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA) and Lockheed Martin corporate health and safety procedures. All site activities should be documented in the site-specific health and safety plan (HASP).

12.0 REFERENCES

This section is not applicable to this SOP.

13.0 APPENDICES

A - Figures



STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 8 of 14
Rev: 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

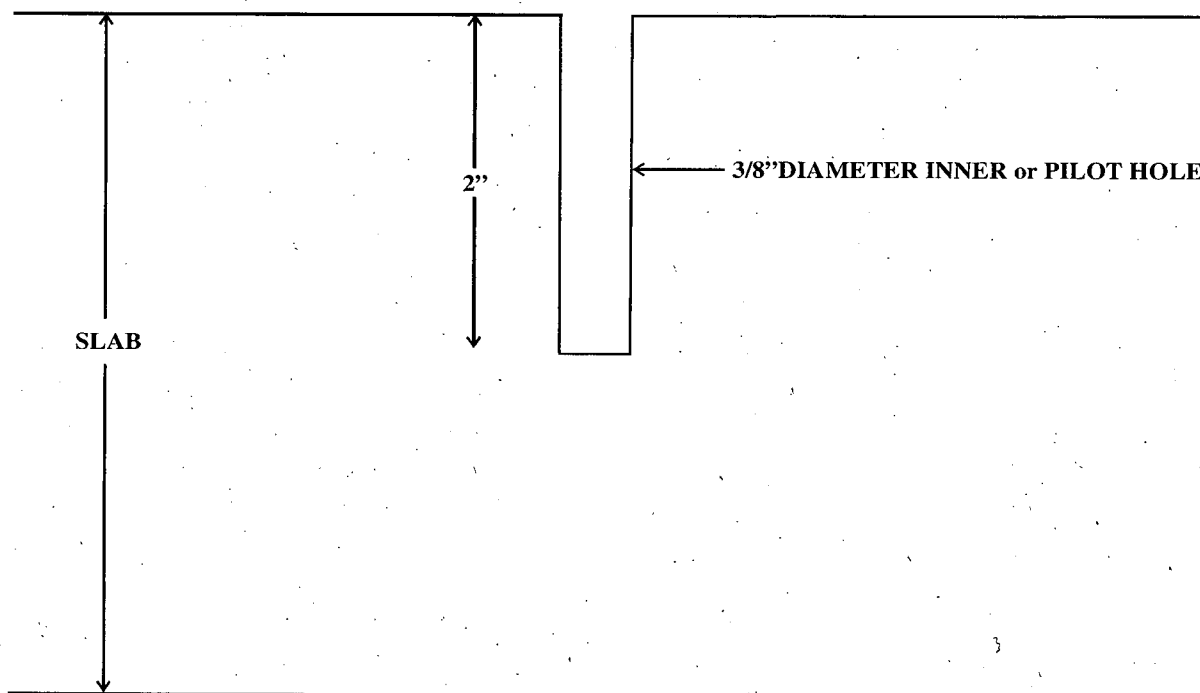
APPENDIX A
Soil Gas Installation Figures
SOP #2082
March 2007

STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 9 of 14
Rev. 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

FIGURE 1
INNER or PILOT HOLE

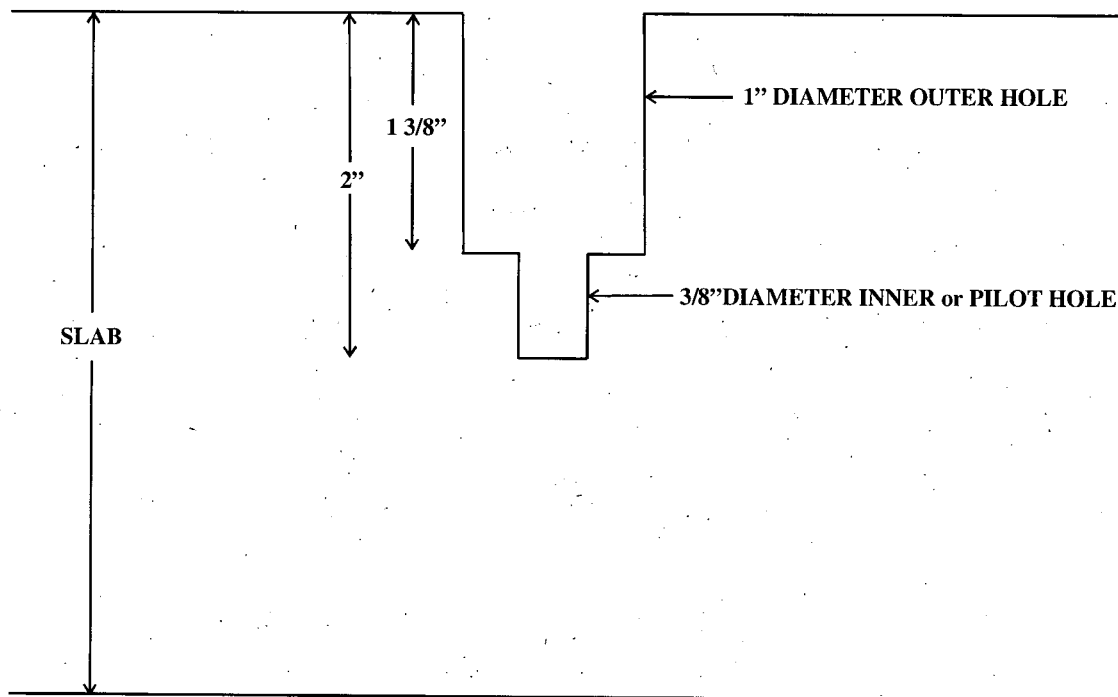


STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 10 of 14
Rev. 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

FIGURE 2
OUTER HOLE



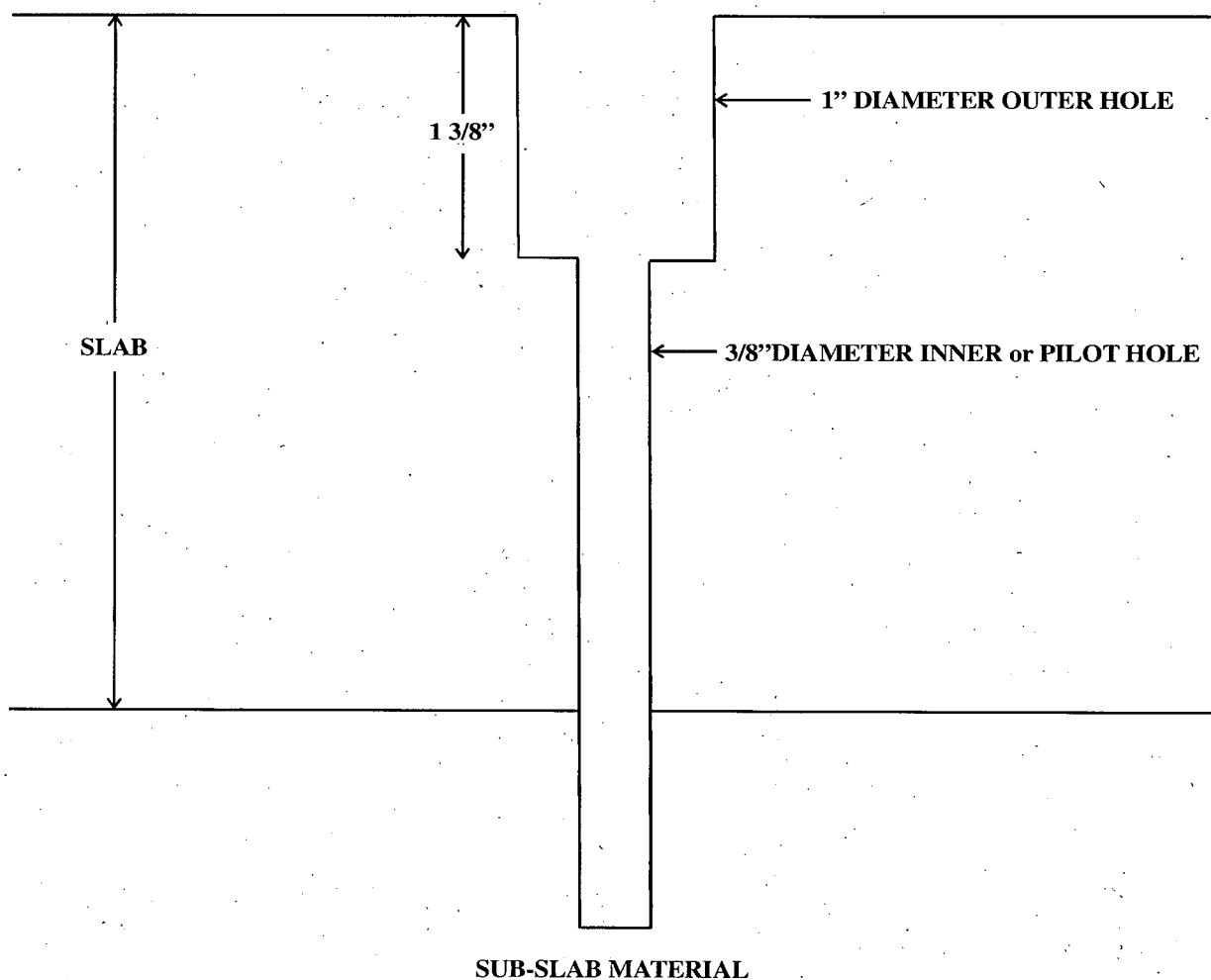
STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 11 of 14
Rev. 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

FIGURE 3

COMPLETED HOLE PRIOR to PROBE INSTALLATION



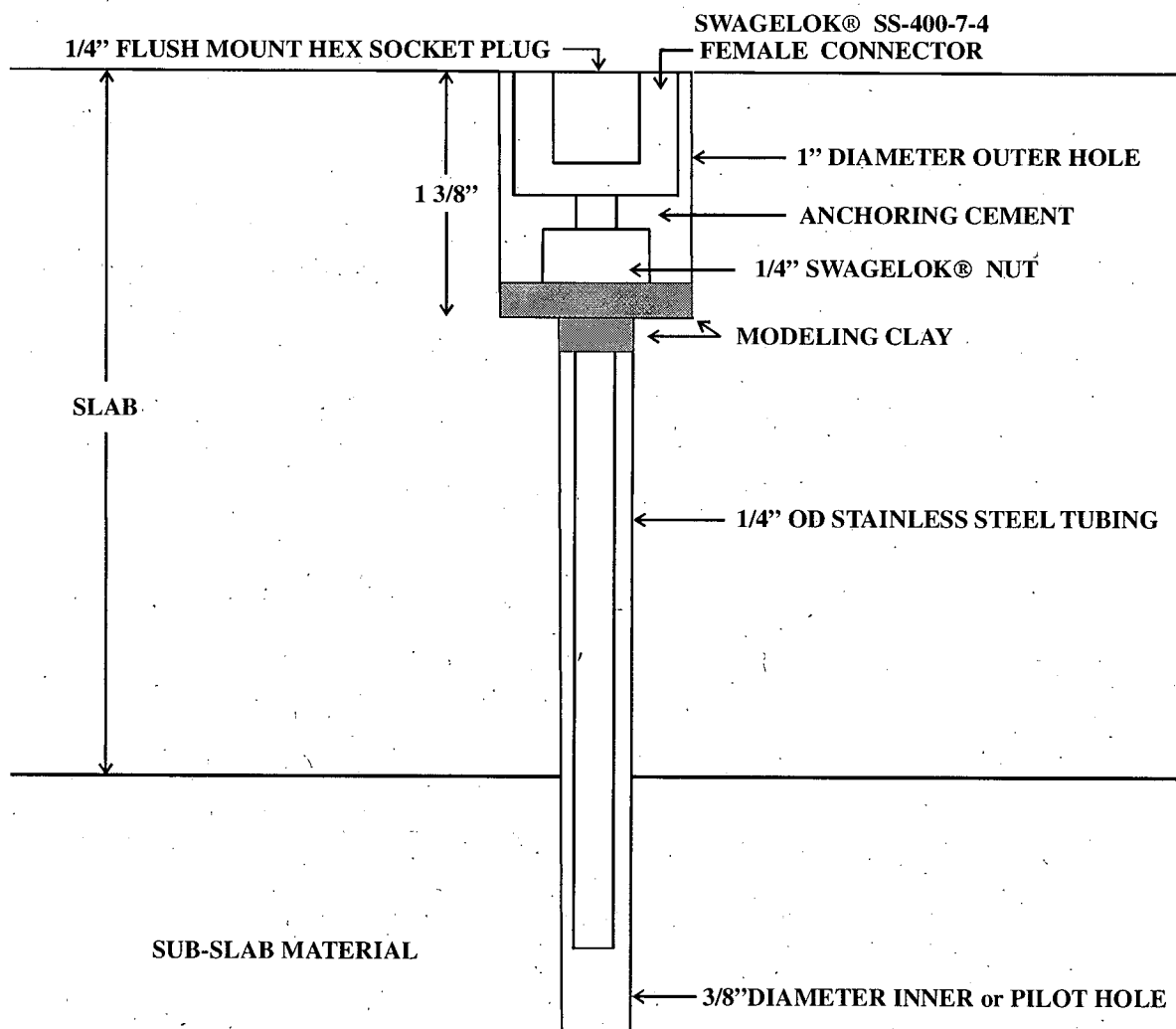
STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 12 of 14
Rev. 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

FIGURE 4

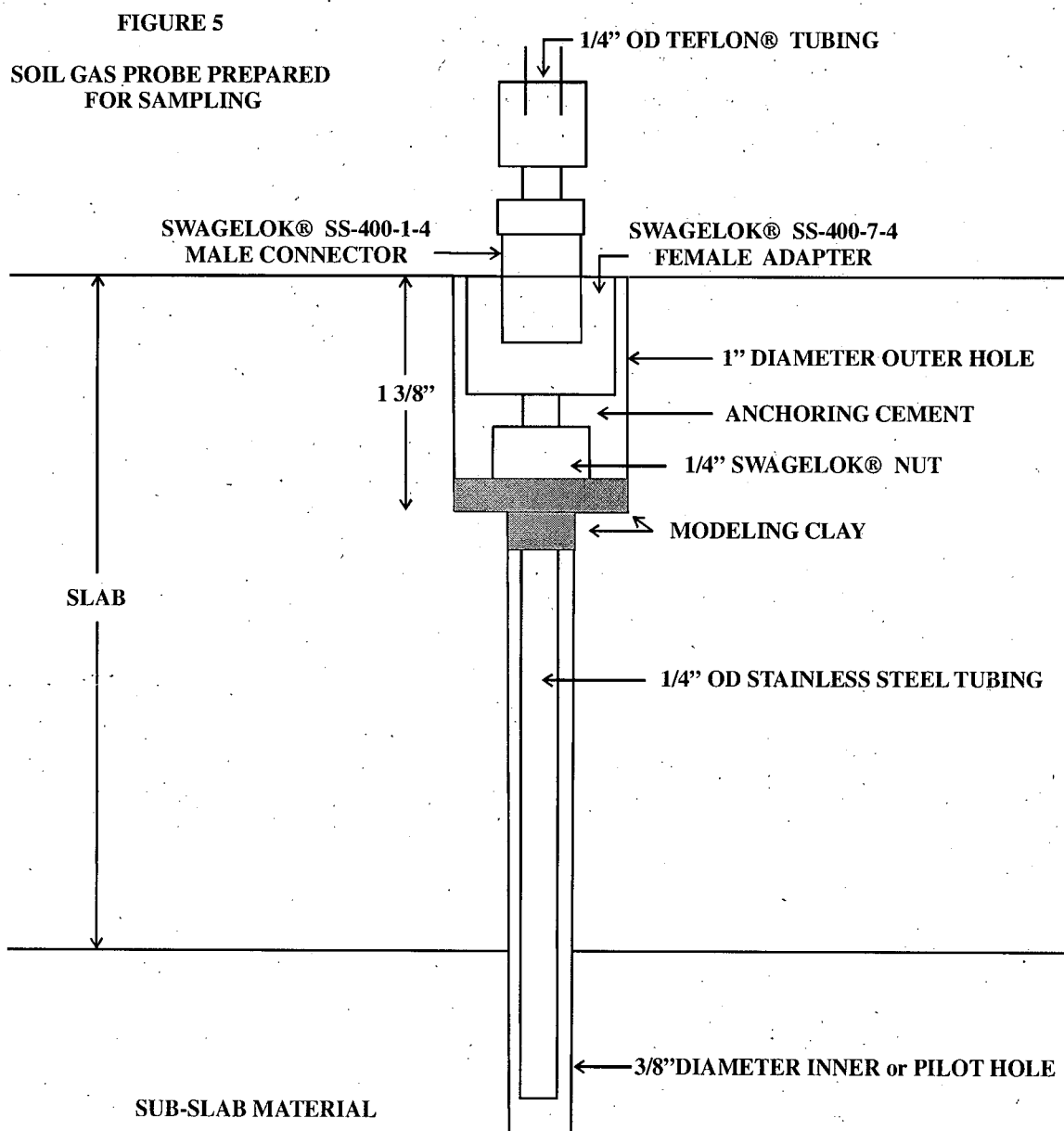
SOIL GAS PROBE INSTALLED



STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 13 of 14
Rev. 0.0
DATE: 03/29/07

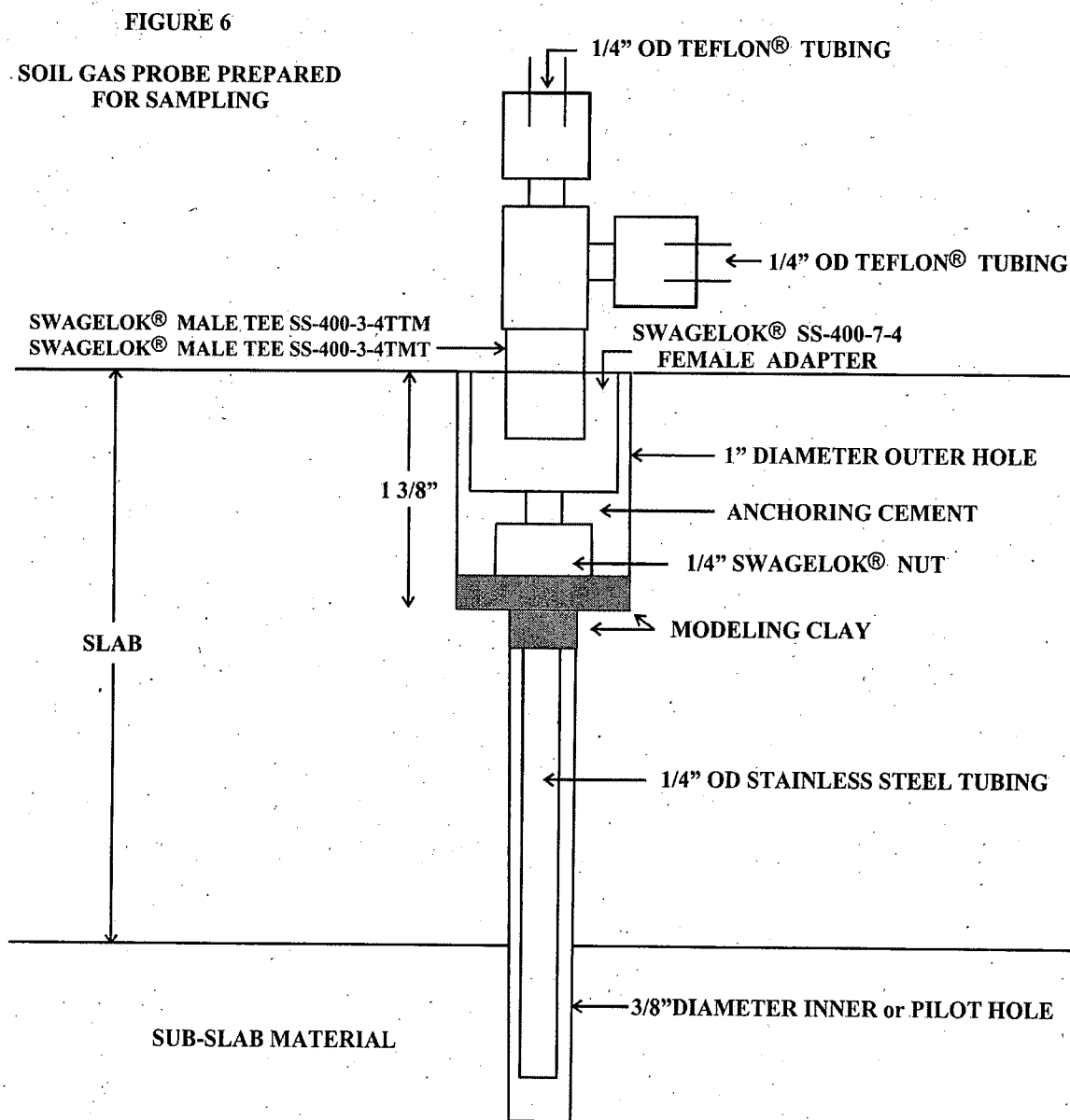
CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS



STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 14 of 14
Rev. 0.0
DATE: 03/29/07

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS





GENERAL FIELD SAMPLING GUIDELINES

SOP#: 2001
DATE: 08/11/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide general field sampling guidelines that will assist REAC personnel in choosing sampling strategies, location, and frequency for proper assessment of site characteristics. This SOP is applicable to all field activities that involve sampling.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

Sampling is the selection of a representative portion of a larger population, universe, or body. Through examination of a sample, the characteristics of the larger body from which the sample was drawn can be inferred. In this manner, sampling can be a valuable tool for determining the presence, type, and extent of contamination by hazardous substances in the environment.

The primary objective of all sampling activities is to characterize a hazardous waste site accurately so that its impact on human health and the environment can be properly evaluated. It is only through sampling and analysis that site hazards can be measured and the job of cleanup and restoration can be accomplished effectively with minimal risk. The sampling itself must be conducted so that every sample collected retains its original physical form and chemical composition. In this way, sample integrity is insured, quality assurance standards are maintained, and the sample can accurately represent the larger body of

material under investigation.

The extent to which valid inferences can be drawn from a sample depends on the degree to which the sampling effort conforms to the project's objectives. For example, as few as one sample may produce adequate, technically valid data to address the project's objectives. Meeting the project's objectives requires thorough planning of sampling activities, and implementation of the most appropriate sampling and analytical procedures. These issues will be discussed in this procedure.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected, and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest. Sample preservation, containers, handling, and storage for air and waste samples are discussed in the specific SOPs for air and waste sampling techniques.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The nature of the object or materials being sampled may be a potential problem to the sampler. If a material is homogeneous, it will generally have a uniform composition throughout. In this case, any sample increment can be considered representative of the material. On the other hand, heterogeneous samples present problems to the sampler because of changes in the material over distance, both laterally and vertically.

Samples of hazardous materials may pose a safety threat to both field and laboratory personnel. Proper health and safety precautions should be implemented when handling this type of sample.

Environmental conditions, weather conditions, or non-target chemicals may cause problems and/or interferences when performing sampling activities or when sampling for a specific parameter. Refer to the specific SOPs for sampling techniques.

5.0 EQUIPMENT/APPARATUS

The equipment/apparatus required to collect samples must be determined on a site specific basis. Due to the wide variety of sampling equipment available, refer to the specific SOPs for sampling techniques which include lists of the equipment/apparatus required for sampling.

6.0 REAGENTS

Reagents may be utilized for preservation of samples and for decontamination of sampling equipment. The preservatives required are specified by the analysis to be performed. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

7.0 PROCEDURE

7.1 Types of Samples

In relation to the media to be sampled, two basic types of samples can be considered: the environmental sample and the hazardous sample.

Environmental samples are those collected from streams, ponds, lakes, wells, and are off-site samples that are not expected to be contaminated with hazardous materials. They usually do not require the special handling procedures typically used for concentrated wastes. However, in certain instances, environmental samples can contain elevated concentrations of pollutants and in such cases, would have to be handled as hazardous samples.

Hazardous or concentrated samples are those collected from drums, tanks, lagoons, pits, waste piles, fresh spills, or areas previously identified as contaminated, and require special handling procedures because of their potential toxicity or hazard. These samples can be further subdivided based on their degree of hazard; however, care should be taken when handling and shipping any wastes believed to be concentrated regardless of the degree.

The importance of making the distinction between environmental and hazardous samples is two-fold:

- (1) Personnel safety requirements: Any sample thought to contain enough hazardous materials to pose a safety threat should be designated as hazardous and handled in a manner which ensures the safety of both field and laboratory personnel.
- (2) Transportation requirements: Hazardous samples must be packaged, labeled, and shipped according to the International Air Transport Association (IATA) Dangerous Goods Regulations or Department of Transportation (DOT) regulations and U.S. EPA guidelines.

7.2 Sample Collection Techniques

In general, two basic types of sample collection techniques are recognized, both of which can be used for either environmental or hazardous samples.

Grab Samples

A grab sample is defined as a discrete aliquot representative of a specific location at a given point in time. The sample is collected all at once at one particular point in the sample medium. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples will decrease.

Composite Samples

Composites are nondiscrete samples composed of more than one specific aliquot collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and can in certain instances be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing can mask problems by diluting isolated concentrations of some hazardous compounds below detection limits.

Compositing is often used for environmental samples and may be used for hazardous samples under certain conditions. For example, compositing of hazardous waste is often performed after compatibility tests have

been completed to determine an average value over a number of different locations (group of drums). This procedure generates data that can be useful by providing an average concentration within a number of units, can serve to keep analytical costs down, and can provide information useful to transporters and waste disposal operations.

For sampling situations involving hazardous wastes, grab sampling techniques are generally preferred because grab sampling minimizes the amount of time sampling personnel must be in contact with the wastes, reduces risks associated with compositing unknowns, and eliminates chemical changes that might occur due to compositing.

7.3 Types of Sampling Strategies

The number of samples that should be collected and analyzed depends on the objective of the investigation. There are three basic sampling strategies: random, systematic, and judgmental sampling.

Random sampling involves collection of samples in a nonsystematic fashion from the entire site or a specific portion of a site. Systematic sampling involves collection of samples based on a grid or a pattern which has been previously established. When judgmental sampling is performed, samples are collected only from the portion(s) of the site most likely to be contaminated. Often, a combination of these strategies is the best approach depending on the type of the suspected/known contamination, the uniformity and size of the site, the level/type of information desired, etc.

7.4 QA Work Plans (QAWP)

A QAWP is required when it becomes evident that a field investigation is necessary. It should be initiated in conjunction with, or immediately following, notification of the field investigation. This plan should be clear and concise and should detail the following basic components, with regard to sampling activities:

- C Objective and purpose of the investigation.
- C Basis upon which data will be evaluated.
- C Information known about the site including location, type and size of the facility, and length of operations/abandonment.
- C Type and volume of contaminated material, contaminants of concern (including

concentration), and basis of the information/data.

- C Technical approach including media/matrix to be sampled, sampling equipment to be used, sample equipment decontamination (if necessary), sampling design and rationale, and SOPs or description of the procedure to be implemented.
- C Project management and reporting, schedule, project organization and responsibilities, manpower and cost projections, and required deliverables.
- C QA objectives and protocols including tables summarizing field sampling and QA/QC analysis and objectives.

Note that this list of QAWP components is not all-inclusive and that additional elements may be added or altered depending on the specific requirements of the field investigation. It should also be recognized that although a detailed QAWP is quite important, it may be impractical in some instances. Emergency responses and accidental spills are prime examples of such instances where time might prohibit the development of site-specific QAWPs prior to field activities. In such cases, investigators would have to rely on general guidelines and personal judgment, and the sampling or response plans might simply be a strategy based on preliminary information and finalized on site. In any event, a plan of action should be developed, no matter how concise or informal, to aid investigators in maintaining a logical and consistent order to the implementation of their task.

7.5 Legal Implications

The data derived from sampling activities are often introduced as critical evidence during litigation of a hazardous waste site cleanup. Legal issues in which sampling data are important may include cleanup cost recovery, identification of pollution sources and responsible parties, and technical validation of remedial design methodologies. Because of the potential for involvement in legal actions, strict adherence to technical and administrative SOPs is essential during both the development and implementation of sampling activities.

Technically valid sampling begins with thorough planning and continues through the sample collection and analytical procedures. Administrative requirements involve thorough, accurate

documentation of all sampling activities. Documentation requirements include maintenance of a chain of custody, as well as accurate records of field activities and analytical instructions. Failure to observe these procedures fully and consistently may result in data that are questionable, invalid and non-defensible in court, and the consequent loss of enforcement proceedings.

8.0 CALCULATIONS

Refer to the specific SOPs for any calculations which are associated with sampling techniques.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

Refer to the specific SOPs for the type and frequency of QA/QC samples to be analyzed, the acceptance criteria for the QA/QC samples, and any other QA/QC activities which are associated with sampling techniques.

10.0 DATA VALIDATION

Refer to the specific SOPs for data validation activities that are associated with sampling techniques.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and corporate health and safety procedures.



U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 1 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

CONTENTS

- 1.0 SCOPE AND APPLICATION
- 2.0 METHOD SUMMARY
- 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE
- 4.0 POTENTIAL PROBLEMS
- 5.0 EQUIPMENT
- 6.0 REAGENTS
- 7.0 PROCEDURES
 - 7.1 Preparation
 - 7.2 Sample Collection
 - 7.2.1 Surface Soil Samples
 - 7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers
 - 7.2.3 Sampling at Depth with a Trier
 - 7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler
 - 7.2.5 Test Pit/Trench Excavation
- 8.0 CALCULATIONS
- 9.0 QUALITY ASSURANCE/QUALITY CONTROL
- 10.0 DATA VALIDATION
- 11.0 HEALTH AND SAFETY
- 12.0 REFERENCES
- 13.0 APPENDIX
 - Figures



U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 2 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of representative soil samples. Sampling depths are assumed to be those that can be reached without the use of a drill rig, direct-push, or other mechanized equipment (except for a back-hoe). Analysis of soil samples may determine whether concentrations of specific pollutants exceed established action levels, or if the concentrations of pollutants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriate site report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (disturbed vs. undisturbed), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and scoop. Sampling at greater depths may be performed using a hand auger, continuous flight auger, a trier, a split-spoon, or, if required, a backhoe.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is not generally recommended. Samples should, however, be cooled and protected from sunlight to minimize any potential reaction. The amount of sample to be collected and proper sample container type are discussed in ERT/REAC SOP #2003 Rev. 0.0 08/11/94, *Sample Storage, Preservation and Handling*.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary potential problems associated with soil sampling - cross contamination of samples and improper sample collection. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results.

5.0 EQUIPMENT



U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 3 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

Soil sampling equipment includes the following:

- Maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Survey equipment or global positioning system (GPS) to locate sampling points
- Tape measure
- Survey stakes or flags
- Camera and film
- Stainless steel, plastic, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Logbook
- Labels
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Cooler(s)
- Ice
- Vermiculite
- Decontamination supplies/equipment
- Canvas or plastic sheet
- Spade or shovel
- Spatula
- Scoop
- Plastic or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoons
- Vehimeyer soil sampler outfit
 - Tubes
 - Points
 - Drive head
 - Drop hammer
 - Puller jack and grip
- Backhoe



U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 4 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

Reagents are not used for the preservation of soil samples. Decontamination solutions are specified in ERT/REAC SOP #2006 Rev. 0.0 08/11/94, *Sampling Equipment Decontamination*, and the site specific work plan.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies required.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare schedules and coordinate with staff, client, and regulatory agencies, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Use stakes, flagging, or buoys to identify and mark all sampling locations. Specific site factors, including extent and nature of contaminant, should be considered when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared by the property owner or the On-Scene-Coordinator (OSC) prior to soil sampling; and utility clearance should always be confirmed before beginning work.

7.2 Sample Collection

7.2.1 Surface Soil Samples

Collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. Surface material is removed to the required depth and a stainless steel or plastic scoop is then used to collect the sample.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. Tools plated with chrome or other materials should not be used. Plating is particularly common with garden implements such as potting trowels.

The following procedure is used to collect surface soil samples:



U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 5 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
3. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

This system consists of an auger, or a thin-wall tube sampler, a series of extensions, and a "T" handle (Figure 1, Appendix A). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin wall tube sampler. The system is then lowered down the borehole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected from the thin wall tube sampler.

Several types of augers are available; these include: bucket type, continuous flight (screw), and post-hole augers. Bucket type augers are better for direct sample recovery because they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights. The continuous flight augers are satisfactory when a composite of the complete soil column is desired. Post-hole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil and cannot be used below a depth of approximately three feet.

The following procedure is used for collecting soil samples with the auger:

1. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.



U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 6 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first three to six inches of surface soil for an area approximately six inches in radius around the drilling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger, collect the sample after the auger is removed from the hole and proceed to Step 10.
5. Remove auger tip from the extension rods and replace with a pre-cleaned thin wall tube sampler. Install the proper cutting tip.
6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.
7. Remove the tube sampler, and unscrew the drill rods.
8. Remove the cutting tip and the core from the device.
9. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container. Sample homogenization is not required.
10. If volatile organic analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly.

When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.



U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 7 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.
12. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

7.2.3 Sampling with a Trier

The system consists of a trier, and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

The following procedure is used to collect soil samples with a sampling trier:

1. Insert the trier (Figure 2, Appendix A) into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes the spillage of sample.
2. Rotate the trier once or twice to cut a core of material.
3. Slowly withdraw the trier, making sure that the slot is facing upward.
4. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split spoon sampling is performed to gain geologic information, all work should



U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 8 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

be performed in accordance with ASTM D1586-98, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils".

The following procedures are used for collecting soil samples with a split spoon:

1. Assemble the sampler by aligning both sides of barrel and then screwing the drive shoe on the bottom and the head piece on top.
2. Place the sampler in a perpendicular position on the sample material.
3. Using a well ring, drive the tube. Do not drive past the bottom of the head piece or compression of the sample will result.
4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth.
5. Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2 and 3 1/2 inch diameters. A larger barrel may be necessary to obtain the required sample volume.
6. Without disturbing the core, transfer it to appropriate labeled sample container(s) and seal tightly.

7.2.5 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil, when detailed examination of soil characteristics are required. This is probably the most expensive sampling method because of the relatively high cost of backhoe operation.

The following procedures are used for collecting soil samples from test pits or trenches:

1. Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of overhead and buried utilities.
2. Review the site specific Health & Safety plan and ensure that all safety precautions including appropriate monitoring equipment are installed as required.



U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 9 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by OSHA regulations.
4. A shovel is used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.
5. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.
6. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.
7. Abandon the pit or excavation according to applicable state regulations. Generally, shallow excavations can simply be backfilled with the removed soil material.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, the following QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration



U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 10 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

activities must occur prior to sampling/operation, and they must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures, in addition to the procedures specified in the site specific Health & Safety Plan..

12.0 REFERENCES

Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Technique and Strategies. EPA-600/4-83-020.

Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043.

U.S. Environmental Protection Agency. 1984 Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, E.R., B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. Samplers and Sampling Procedures for Hazardous Waste Streams. EPA-600/2-80-018.

ASTM D 1586-98, ASTM Committee on Standards, Philadelphia, PA.



U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 11 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

APPENDIX A

Figures

SOP #2012

February 2000



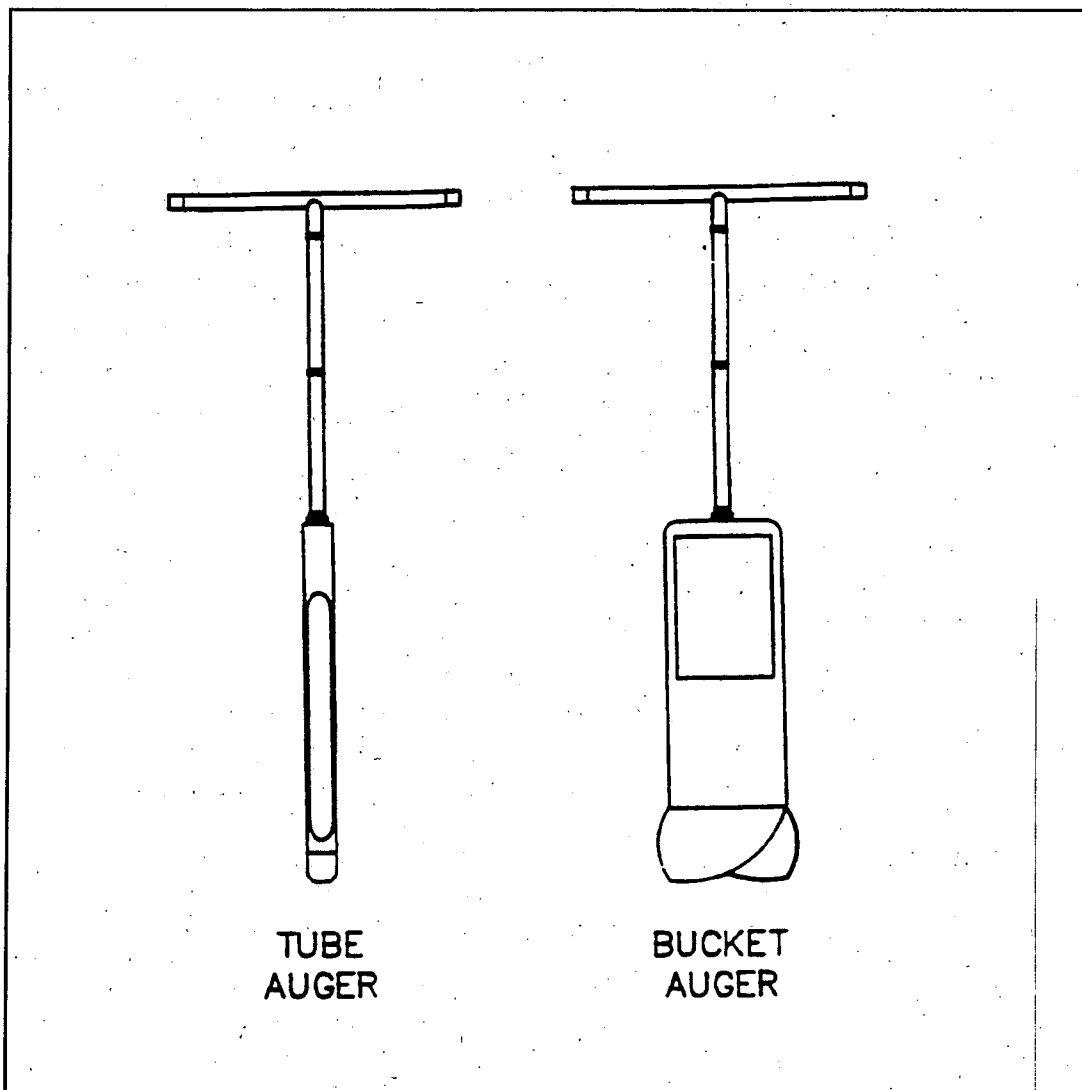
U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 12 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

FIGURE 1. Sampling Augers





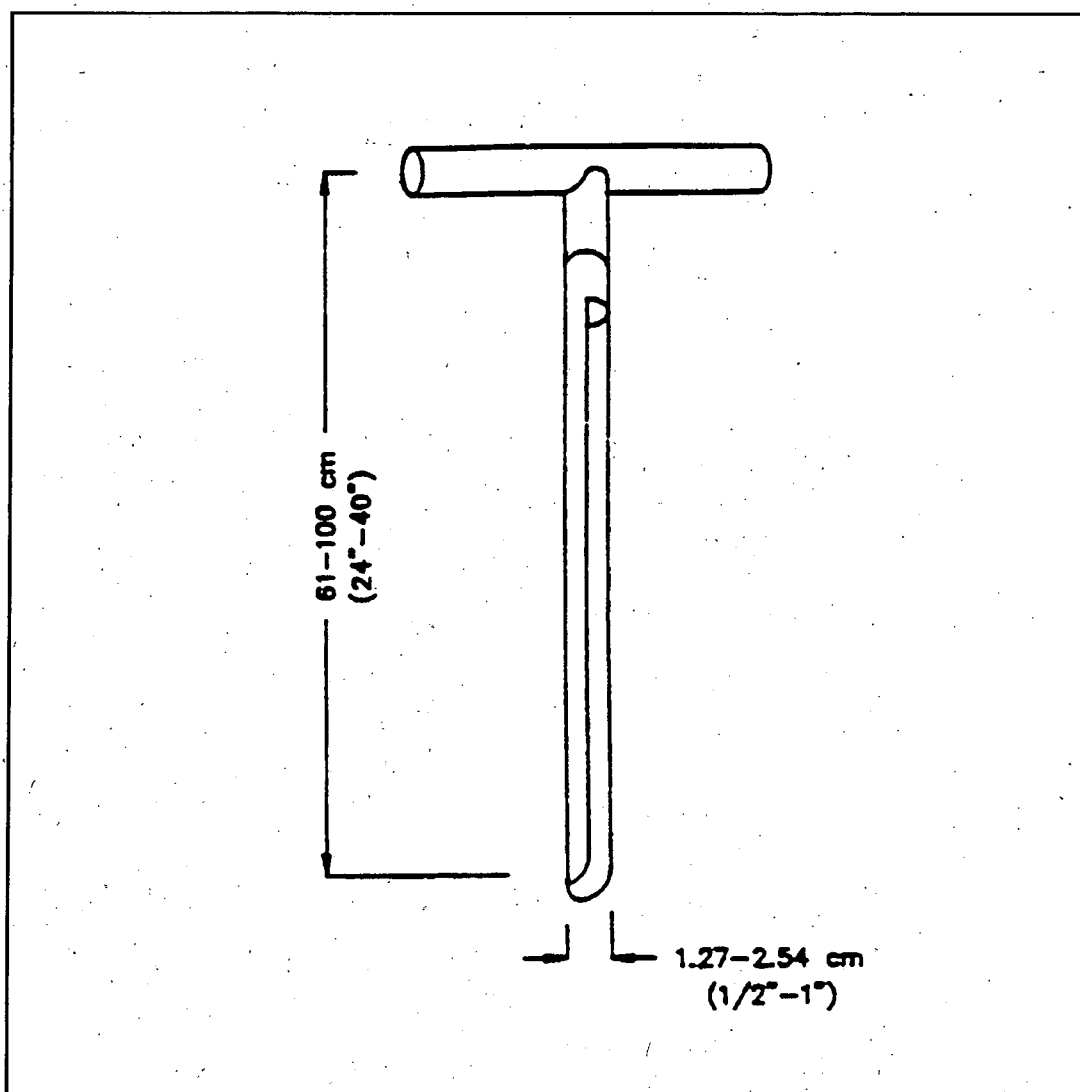
U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2012
PAGE: 13 of 13
REV: 0.0
DATE: 02/18/00

SOIL SAMPLING

FIGURE 2. Sampling Trier





SUMMA CANISTER SAMPLING

SOP#: 1704
DATE: 07/27/95
REV. #: 0.1

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to describe a procedure for sampling of volatile organic compounds (VOCs) in ambient air. The method is based on samples collected as whole air samples in Summa passivated stainless steel canisters. The VOCs are subsequently separated by gas chromatography (GC) and measured by mass-selective detector or multidetector techniques. This method presents procedures for sampling into canisters at final pressures both above and below atmospheric pressure (respectively referred to as pressurized and subatmospheric pressure sampling).

This method is applicable to specific VOCs that have been tested and determined to be stable when stored in pressurized and subatmospheric pressure canisters. The organic compounds that have been successfully collected in pressurized canisters by this method are listed in the Volatile Organic Compound Data Sheet (Appendix A). These compounds have been measured at the parts per billion by volume (ppbv) level.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure or other procedure limitations. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

Both subatmospheric pressure and pressurized sampling modes use an initially evacuated canister. Both modes may also use a mass flow controller/vacuum pump arrangement to regulate flow. With the above configuration, a sample of ambient air

is drawn through a sampling train comprised of components that regulate the rate and duration of sampling into a pre-evacuated Summa passivated canister. Alternatively, subatmospheric pressure sampling may be performed using a fixed orifice, capillary, or adjustable micrometering valve in lieu of the mass flow controller/vacuum pump arrangement for taking grab samples or short duration time-integrated samples. Usually, the alternative types of flow controllers are appropriate only in situations where screening samples are taken to assess for future sampling activities.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

After the air sample is collected, the canister valve is closed, an identification tag is attached to the canister, and the canister is transported to a laboratory for analysis. Upon receipt at the laboratory, the canister tag data is recorded. Sample holding times and expiration should be determined prior to initiating field activities.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Contamination may occur in the sampling system if canisters are not properly cleaned before use. Additionally, all other sampling equipment (e.g., pump and flow controllers) should be thoroughly cleaned.

5.0 EQUIPMENT/APPARATUS

The following equipment/apparatus (Figure 1, Appendix B) is required:

5.1 Subatmospheric Pressure Sampling Equipment

1. VOC canister sampler - whole air sampler capable of filling an initially evacuated canister by action of the flow controlled pump from vacuum to near atmospheric pressure. (Andersen Samplers Inc., Model 87-100 or equivalent).
2. Sampling inlet line - stainless steel tubing to connect the sampler to the sample inlet.
3. Sample canister - leak-free stainless steel pressure vessels of desired volume with valve and Summa passivated interior surfaces (Scientific Instrumentation Specialist, Inc., ID 83843, Andersen Samplers, Inc., or equivalent).
4. Particulate matter filter - 2- μ m sintered stainless steel in-line filter (Nupro Co., Model SS-2F-K4-2, or equivalent).
5. Chromatographic grade stainless steel tubing and fittings - for interconnections (Alltech Associates, Cat. #8125, or equivalent). All materials in contact with sample, analyte, and support gases should be chromatographic grade stainless steel.
6. Fixed orifice, capillary, or adjustable micrometering valve - used in lieu of the electronic flow controller/vacuum pump for grab samples or short duration time-integrated samples.

5.2 Pressurized Sampling Equipment

1. VOC canister sampler - whole air sampler capable of filling an initially evacuated canister by action of the flow controlled pump from vacuum to near atmospheric pressure. (Andersen Samplers Inc., Model 87-100).
2. Sampling inlet line - stainless steel tubing to connect the sampler to the sample inlet.
3. Sample canister - leak-free stainless steel pressure vessels of desired volume with valve and Summa passivated interior

surfaces (Scientific Instrumentation Specialist, Inc., ID 83843, Andersen Samplers, Inc., or equivalent).

4. Particulate matter filter - 2- μ m sintered stainless steel in-line filter (Nupro Co., Model SS-2F-K4-2, or equivalent).
5. Chromatographic grade stainless steel tubing and fittings - for interconnections (Alltech Associates, Cat. #8125, or equivalent). All materials in contact with sample, analyte, and support gases should be chromatographic grade stainless steel.

6.0 REAGENTS

This section is not applicable to this SOP.

7.0 PROCEDURE

7.1 Subatmospheric Pressure Sampling

7.1.1 Sampling Using a Fixed Orifice, Capillary, or Adjustable Micrometering Valve

1. Prior to sample collection, the appropriate information is completed on the Canister Sampling Field Data Sheet (Appendix C).
2. A canister, which is evacuated to 0.05 mm Hg and fitted with a flow restricting device, is opened to the atmosphere containing the VOCs to be sampled.
3. The pressure differential causes the sample to flow into the canister.
4. This technique may be used to collect grab samples (duration of 10 to 30 seconds) or time-integrated samples (duration of 12 to 24 hours). The sampling duration depends on the degree to which the flow is restricted.
5. A critical orifice flow restrictor will have a decrease in the flow rate as the pressure approaches atmospheric.
6. Upon sample completion at the location, the appropriate information is recorded on the

Canister Sampling Field Data Sheet.

7.1.2 Sampling Using a Mass Flow Controller/Vacuum Pump Arrangement (Andersen Sampler Model 87-100)

1. Prior to sample collection the appropriate information is completed on the Canister Sampling Field Data Sheet (Appendix C).
2. A canister, which is evacuated to 0.05 mm Hg and connected in line with the sampler, is opened to the atmosphere containing the VOCs to be sampled.
3. A whole air sample is drawn into the system through a stainless steel inlet tube by a direct drive blower motor assembly.
4. A small portion of this whole air sample is pulled from the inlet tube by a specially modified inert vacuum pump in conjunction with a mass flow controller.
5. The initially evacuated canister is filled by action of the flow controlled pump to near atmospheric pressure.
6. A digital time-program is used to pre-select sample duration and start and stop times.
7. Upon sample completion at the location, the appropriate information is recorded on the Canister Sampling Field Data Sheet.

7.2 Pressurized Sampling

7.2.1 Sampling Using a Mass Flow Controller/Vacuum Pump Arrangement (Anderson Sampler Model 87-100)

1. Prior to sample commencement at the location, the appropriate information is completed on the Canister Sampling Field Data Sheet.
2. A canister, which is evacuated to 0.05 mm Hg and connected in line with the sampler, is opened to the atmosphere containing the

VOCs to be sampled.

3. A whole air sample is drawn into the system through a stainless steel inlet tube by a direct drive blower motor assembly.
4. A small portion of this whole air sample is pulled from the inlet tube by a specially modified inert vacuum pump in conjunction with a mass flow controller.
5. The initially evacuated canister is filled by action of the flow controlled pump to a positive pressure not to exceed 25 psig.
6. A digital time-programmer is used to pre-select sample duration and start and stop times.
7. Upon sample completion at the location, the appropriate information is recorded on the Canister Sampling Field Data Sheet.

8.0 CALCULATIONS

1. A flow control device is chosen to maintain a constant flow into the canister over the desired sample period. This flow rate is determined so the canister is filled to about 88.1 kPa for subatmospheric pressure sampling or to about one atmosphere above ambient pressure for pressurized sampling over the desired sample period. The flow rate can be calculated by:

$$F = \frac{(P)(V)}{(T)(60)}$$

where:

F	=	flow rate (cm ³ /min)
P	=	final canister pressure, atmospheres absolute
V	=	volume of the canister (cm ³)
T	=	sample period (hours)

For example, if a 6-L canister is to be filled to 202 kPa (two atmospheres) absolute pressure in 24 hours, the flow rate can be calculated by:

$$F = \frac{(2)(6000)}{(24)(60)} \cdot 8.3 \text{ cm}^3/\text{min}$$

2. If the canister pressure is increased, a dilution factor (DF) is calculated and recorded on the sampling data sheet.

$$DF = \frac{Y_a}{X_a}$$

where:

X_a = canister pressure (kPa, psia) absolute before dilution.
 Y_a = canister pressure (kPa, psia) absolute after dilution.

After sample analysis, detected VOC concentrations are multiplied by the dilution factor to determine concentration in the sampled air.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

The following general quality assurance procedures apply:

1. All data must be documented on standard chain of custody records, field data sheets, or site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and corporate health and safety practices. Specifically, pressurizing of Summa canisters should be performed in a well ventilated room, or preferably under a fume hood. Care must be taken not to exceed 40 psi in the canisters. Canisters are under pressure, albeit only 20-30 psi, and should not be dented or punctured. They should be stored in a cool dry place and always be placed in their plastic shipping boxes during transport and storage.

12.0 REFERENCES

1. Ralph M. Riggin, Technical Assistance Document for Sampling and Analysis of Toxic Organic Compounds in Ambient Air, EPA-600/4-83-027 U. S. Environmental Protection Agency, Research Triangle Park, NC, 1983.
2. W. A. McClenny, J. D. Pleil, T. A. Lumpkin and K. D. Oliver, "Update on Canister-Based Samplers for VOCs," Proceedings of the 1987 EPA/APCA Symposium on Measurement of Toxic and Related Air Pollutants, May, 1987 APCA Publication VIP-8, EPA 600/9-87-010.
3. J. F. Walling, "The Utility of Distributed Air Volume Sets When Sampling Ambient Air Using Solid Adsorbents," Atmospheric Environ., 18:855-859, 1984.
4. J. F. Walling, J. E. Bumgarner, J. D. Driscoll, C. M. Morris, A. E. Riley, and L. H. Wright, "Apparent Reaction Products Desorbed From Tenax Used to Sample Ambient Air," Atmospheric Environ., 20:51-57, 1986.
5. Portable Instruments User's Manual for Monitoring VOC Sources, EPA-340/1-88-015, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Washington, D.C., June 1986.

6. R. A. Rasmussen and J. E. Lovelock, Atmospheric Measurements Using Canister Technology, J. Geophys. Res., 83: 8369-8378, 1983.
7. R. A. Rasmussen and M. A. K. Khalil, "Atmospheric Halocarbon: Measurements and Analysis of Selected Trace Gases," Proc. NATO ASI on Atmospheric Ozone, BO: 209-231.
8. EPA Method TO-14 "Determination of Volatile Organic Compounds (VOC's) in Ambient Air Using Summa Passivated Canister Sampling and Gas Chromatographic Analysis", May 1988.

APPENDIX A

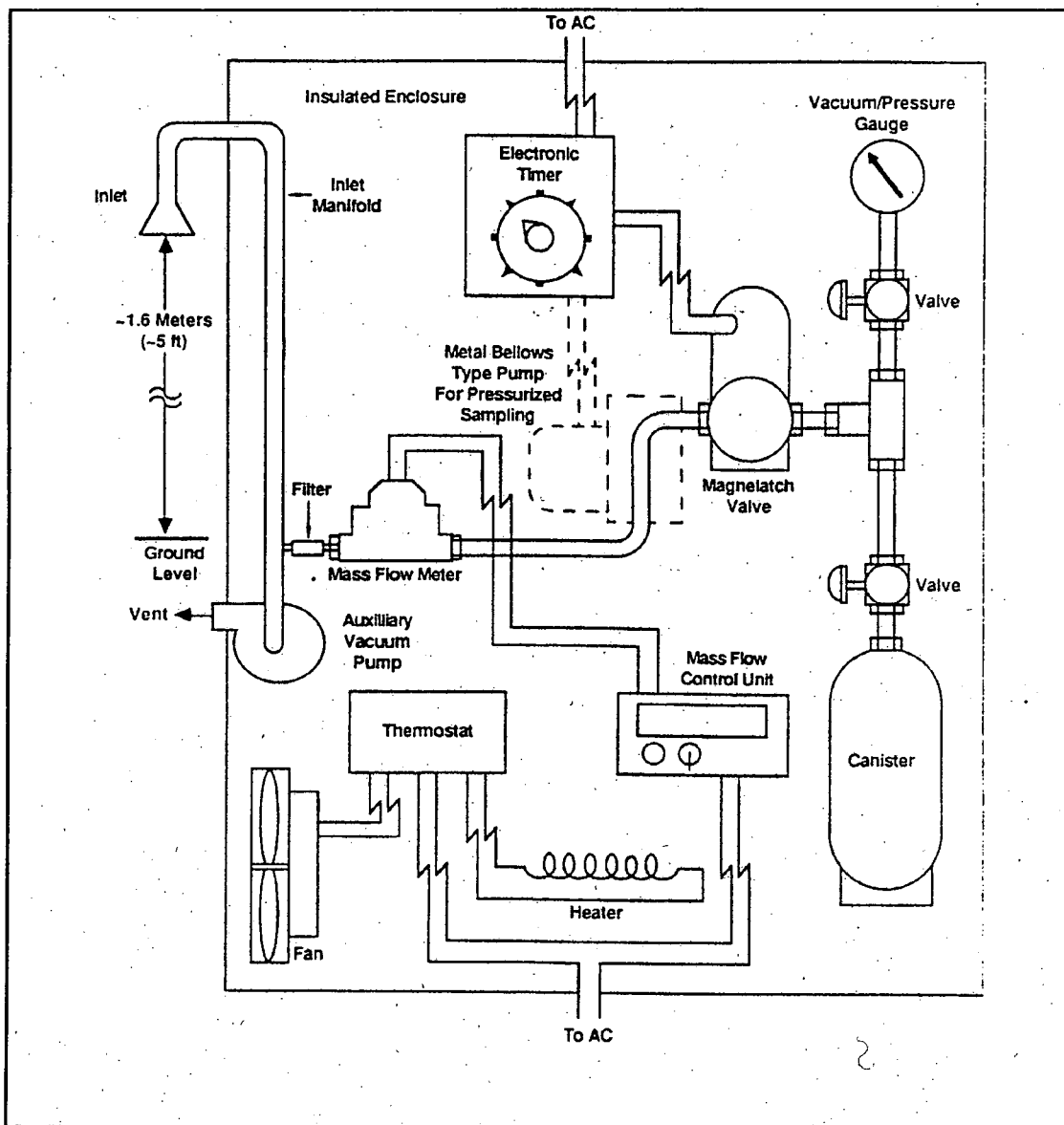
Volatile Organic Compound Data Sheet

TABLE 1. VOLATILE ORGANIC COMPOUND DATA SHEET

COMPOUND (SYNONYM)	FORMULA	MOLECULAR WEIGHT	BOILING POINT (°C)	MELTING POINT (°C)	CAS NUMBER
Freon 12 (Dichlorodifluoromethane)	<chem>Cl2CF2</chem>	120.91	-29.8	-158.0	74-87-3
Methyl chloride (Chloromethane)	<chem>CH3Cl</chem>	50.49	-24.2	-97.1	
Freon 114 (1,2-Dichloro-1,1,2,2-tetrafluoroethane)	<chem>ClCF2CClF2</chem>	170.93	4.1	-94.0	
Vinyl chloride (Chloroethylene)	<chem>CH2=CHCl</chem>	62.50	-13.4	-1538.0	75-01-4
Methyl bromide (Bromomethane)	<chem>CH3Br</chem>	94.94	3.6	-93.6	74-83-9
Ethyl chloride (Chloroethane)	<chem>CH3CH2Cl</chem>	64.52	12.3	-136.4	75-00-3
Freon 11 (Trichlorofluoromethane)	<chem>CCl3F</chem>	137.38	23.7	-111.0	75-35-4
Vinylidene chloride (1,1-Dichloroethene)	<chem>C2H2Cl2</chem>	96.95	31.7	-122.5	
Dichloromethane (Methylene chloride)	<chem>CH2Cl2</chem>	84.94	39.8	-95.1	75-09-2
Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	<chem>CF2ClCCl2F</chem>	187.38	47.7	-36.4	74-34-3
1,1-Dichloroethane (Ethylidene chloride)	<chem>CH3CHCl2</chem>	98.96	57.3	-97.0	
cis-1,2-Dichloroethylene	<chem>CHCl=CHCl</chem>	96.94	60.3	-80.5	
Chloroform (Trichloromethane)	<chem>CHCl3</chem>	119.38	61.7	-63.5	67-66-3
1,2-Dichloroethane (Ethylene dichloride)	<chem>ClCH2CH2Cl</chem>	98.96	83.5	-35.3	107-06-2
Methyl chloroform (1,1,1-Trichloroethane)	<chem>CH3CCl3</chem>	133.41	74.1	-30.4	71-55-6
Benzene (Cyclohexatriene)	<chem>C6H6</chem>	78.12	80.1	5.5	71-43-2
Carbon tetrachloride (tetrachloromethane)	<chem>CCl4</chem>	153.82	76.5	-23.0	56-23-5
1,2-Dichloropropane (Propylene dichloride)	<chem>CH3CHClCH2Cl</chem>	112.99	96.4	-100.4	78-87-5
Trichloroethylene (Trichloroethene)	<chem>ClCH=CCl2</chem>	131.29	87	-73.0	79-01-6
cis-1,3-Dichloropropene (cis-1,3-dichloropropylene)	<chem>CH3CCl=CHCl</chem>	110.97	76		
trans-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	<chem>ClCH2CH=CHCl</chem>	110.97	112.0		
1,1,2-Trichloroethane (Vinyl trichloride)	<chem>CH2ClCHCl2</chem>	133.41	113.8	-36.5	79-00-5
Toluene (Methyl benzene)	<chem>C6H5CH3</chem>	92.15	110.6	-95.0	108-88-3
1,2-Dibromoethane (Ethylene dibromide)	<chem>BrCH2CH2Br</chem>	187.88	131.3	9.8	106-93-4
Tetrachloroethylene (Perchloroethylene)	<chem>Cl2C=CCl2</chem>	165.83	121.1	-19.0	127-18-4
Chlorobenzene (Phenyl chloride)	<chem>C6H5Cl</chem>	112.56	132.0	-45.6	108-90-7
Ethylbenzene	<chem>C6H5C2H5</chem>	106.17	136.2	-95.0	100-41-4
m-Xylene (1,3-Dimethylbenzene)	<chem>1,3-(CH3)2C6H4</chem>	106.17	139.1	-47.9	100-42-5
p-Xylene (1,4-Dimethylbenzene)	<chem>1,4-(CH3)2C6H4</chem>	106.17	138.3	13.3	
Styrene (Vinyl benzene)	<chem>C6H5CH=CH2</chem>	104.16	145.2	-30.6	
1,1,2,2-Tetrachloroethane	<chem>CHCl2CHCl2</chem>	167.85	146.2	-36.0	79-34-5
o-Xylene (1,2-Dimethylbenzene)	<chem>1,2-(CH3)2C6H4</chem>	106.17	144.4	-25.2	108-67-8
1,3,5-Trimethylbenzene (Mesitylene)	<chem>1,3,5-(CH3)3C6H3</chem>	120.20	164.7	-44.7	
1,2,4-Trimethylbenzene (Pseudocumene)	<chem>1,2,4-(CH3)3C6H3</chem>	120.20	169.3	-43.8	
m-Dichlorobenzene (1,3-Dichlorobenzene)	<chem>1,3-Cl2C6H4</chem>	147.01	173.0	-24.7	541-73-1
Benzyl chloride (α-Chlorotoluene)	<chem>C6H5CH2Cl</chem>	126.59	179.3	-39.0	100-44-7
o-Dichlorobenzene (1,2-Dichlorobenzene)	<chem>1,2-Cl2C6H4</chem>	147.01	180.5	-17.0	95-50-1
p-Dichlorobenzene (1,4-Dichlorobenzene)	<chem>1,4-Cl2C6H4</chem>	147.01	174.0	53.1	106-46-7
1,2,4-Trichlorobenzene	<chem>1,2,4-Cl3C6H3</chem>	181.45	213.5	17.0	120-82-1
Hexachlorobutadiene (1,1,2,3,4,4-Hexachloro-1,3-butadiene)					

APPENDIX B

FIGURE 1. Subatmospheric/Pressurized Sampling Equipment



APPENDIX C

Canister Sampling Field Data Sheet

Page ____ of ____

SUMMA AIR SAMPLING WORK SHEET

Site: _____

Site#: _____

Samplers: _____

Work Assignment Manager: _____

Date: _____

Project Leader: _____

Sample #					
Location					
SUMMA ID					
Orifice Used					
Analysis/Method					
Time (Start)					
Time (Stop)					
Total Time					
SUMMA WENT TO AMBIENT	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO
Pressure Gauge					
Pressure Gauge					
Flow Rate (Pre)					
Flow Rate (Post)					
Flow Rate (Average)					
<div style="border: 1px solid black; padding: 5px;"> MET Station On-site? Y / N </div>					
General Comments:					



SAMPLING EQUIPMENT DECONTAMINATION

SOP#: 2006
DATE: 08/11/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure

water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. An acid rinse provides a low pH media for trace metals removal and is included in the decontamination process if metal samples are to be collected. It is followed by another distilled/deionized water rinse. If sample analysis does not include metals, the acid rinse step can be omitted. Next, a high purity solvent rinse is performed for trace organics removal if organics are a concern at the site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. Acetone is typically chosen because it is an excellent solvent, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern at a given site or if Target Compound List analysis (which includes acetone) is to be performed, another solvent may be substituted. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

The decontamination procedure described above may be summarized as follows:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. 10% nitric acid rinse
6. Distilled/deionized water rinse
7. Solvent rinse (pesticide grade)
8. Air dry
9. Distilled/deionized water rinse

If a particular contaminant fraction is not present at the site, the nine (9) step decontamination procedure specified above may be modified for site specificity. For example, the nitric acid rinse may be eliminated if metals are not of concern at a site. Similarly, the solvent rinse may be eliminated if organics are not of

concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected and the proper sample container type (i.e., glass; plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest.

More specifically, sample collection and analysis of decontamination waste may be required before beginning proper disposal of decontamination liquids and solids generated at a site. This should be determined prior to initiation of site activities.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

C The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free (specifically for the contaminants of concern).

C The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.

C If acids or solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.

C Damage can be incurred by acid and solvent washing of complex and sophisticated sampling equipment.

5.0 EQUIPMENT/APPARATUS

Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-

bristle scrub brushes or long-handled bottle brushes can be used to remove contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children's wading pools can also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

5.1 Decontamination Solutions

- C Non-phosphate detergent
- C Selected solvents (acetone, hexane, nitric acid, etc.)
- C Tap water
- C Distilled or deionized water

5.2 Decontamination Tools/Supplies

- C Long and short handled brushes
- C Bottle brushes
- C Drop cloth/plastic sheeting
- C Paper towels
- C Plastic or galvanized tubs or buckets
- C Pressurized sprayers (H₂O)
- C Solvent sprayers
- C Aluminum foil

5.3 Health and Safety Equipment

Appropriate personal protective equipment (i.e., safety glasses or splash shield, appropriate gloves, aprons or coveralls, respirator, emergency eye wash)

5.4 Waste Disposal

- C Trash bags
- C Trash containers
- C 55-gallon drums
- C Metal/plastic buckets/containers for storage and disposal of decontamination solutions

6.0 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions. Table 1 (Appendix A) lists solvent rinses which may be required for elimination of particular chemicals. In

general, the following solvents are typically utilized for decontamination purposes:

- C 10% nitric acid is typically used for inorganic compounds such as metals. An acid rinse may not be required if inorganics are not a contaminant of concern.
- C Acetone (pesticide grade)⁽¹⁾
- C Hexane (pesticide grade)⁽¹⁾
- C Methanol⁽¹⁾

⁽¹⁾ - Only if sample is to be analyzed for organics.

7.0 PROCEDURES

As part of the health and safety plan, a decontamination plan should be developed and reviewed. The decontamination line should be set up before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- C The number, location, and layout of decontamination stations.
- C Decontamination equipment needed.
- C Appropriate decontamination methods.
- C Methods for disposal of contaminated clothing, equipment, and solutions.
- C Procedures can be established to minimize the potential for contamination. This may include: (1) work practices that minimize contact with potential contaminants; (2) using remote sampling techniques; (3) covering monitoring and sampling equipment with plastic, aluminum foil, or other protective material; (4) watering down dusty areas; (5) avoiding laying down equipment in areas of obvious contamination; and (6) use of disposable sampling equipment.

7.1 Decontamination Methods

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. Various decontamination methods will remove contaminants by: (1) flushing or other physical action, or (2) chemical complexing to inactivate

contaminants by neutralization, chemical reaction, disinfection, or sterilization.

Physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods, as follows:

7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The mechanical abrasive cleaning methods are most commonly used at hazardous waste sites. The following abrasive methods are available:

Mechanical

Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, time of application, and angle at which the abrasive strikes the surface will dictate cleaning efficiency. Disadvantages of this method are the inability to control the amount of material removed and the large amount of waste generated.

Wet Blasting

Wet blast cleaning involves use of a suspended fine abrasive. The abrasive/water mixture is delivered by compressed air to the contaminated area. By using a very fine abrasive, the amount of materials removed can be carefully controlled.

7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with pressure. In general, the equipment surface is not removed using non-abrasive methods.

Low-Pressure Water

This method consists of a container which is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high-pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow rates usually range from 20 to 140 liters per minute.

Ultra-High-Pressure Water

This system produces a water jet that is pressured from 1,000 to 4,000 atmospheres. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 meters/second (m/s) (1,000 atm) to 900 m/s (4,000 atm). Additives can be used to enhance the cleaning action.

Rinsing

Contaminants are removed by rinsing through dilution, physical attraction, and solubilization.

Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps hooked on a fence, placed on a drum, or wrapped in plastic bags are not likely to become heavily contaminated. A damp cloth should be used to wipe off contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set.

Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment. This method of decontamination is typically performed off-site.

7.2 Field Sampling Equipment Decontamination Procedures

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. The spread of contaminants is further reduced by separating each decontamination station by a minimum of three (3) feet. Ideally, the contamination should decrease as the equipment progresses from one station to another farther along in the line.

A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC) which is in the CRZ. Figure 1 (Appendix B) shows a typical contaminant reduction zone layout. The CRC controls access into and out of the exclusion zone and confines decontamination activities to a limited area. The CRC boundaries should be conspicuously marked. The far end is the hotline, the boundary between the exclusion zone and the contamination reduction zone. The size of the decontamination corridor depends on the number of stations in the decontamination process, overall dimensions of the work zones, and amount of space available at the site. Whenever possible, it should be a straight line.

Anyone in the CRC should be wearing the level of protection designated for the decontamination crew. Another corridor may be required for the entry and exit of heavy equipment. Sampling and monitoring equipment and sampling supplies are all maintained outside of the CRC. Personnel don their equipment away from the CRC and enter the exclusion zone through a separate access control point at the hotline. One person (or more) dedicated to decontaminating equipment is recommended.

7.2.1 Decontamination Setup

Starting with the most contaminated station, the decontamination setup should be as follows:

Station 1: Segregate Equipment Drop

Place plastic sheeting on the ground (Figure 2, Appendix B). Size will depend on amount of

equipment to be decontaminated. Provide containers lined with plastic if equipment is to be segregated. Segregation may be required if sensitive equipment or mildly contaminated equipment is used at the same time as equipment which is likely to be heavily contaminated.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

As indicated in 7.1.2, a high-pressure wash may be required for compounds which are difficult to remove by washing with brushes. The elevated temperature of the water from the high-pressure washers is excellent at removing greasy/oily compounds. High pressure washers require water and electricity.

A decontamination pad may be required for the high-pressure wash area. An example of a wash pad may consist of an approximately 1 1/2 foot-deep basin lined with plastic sheeting and sloped to a sump at one corner. A layer of sand can be placed over the plastic and the basin is filled with gravel or shell. The sump is also lined with visqueen and a barrel is placed in the hole to prevent collapse. A sump pump is used to remove the water from the sump for transfer into a drum.

Typically heavy machinery is decontaminated at the end of the day unless site sampling requires that the machinery be decontaminated frequently. A separate decontamination pad may be required for heavy equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Prior to setting up Station 3, place plastic sheeting on the ground to cover areas under Station 3 through Station 10.

Fill a wash basin, a large bucket, or child's swimming pool with non-phosphate detergent and tap water. Several bottle and bristle brushes to physically remove contamination should be dedicated to this station. Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 4: Water Basin

Fill a wash basin, a large bucket, or child's swimming

pool with tap water. Several bottle and bristle brushes should be dedicated to this station. Approximately 10-50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 5: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to contain the water during the rinsing process. Approximately 10-20 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 6: Nitric Acid Sprayers

Fill a spray bottle with 10% nitric acid. An acid rinse may not be required if inorganics are not a contaminant of concern. The amount of acid will depend on the amount of equipment to be decontaminated. Provide a 5-gallon bucket or basin to collect acid during the rinsing process.

Station 7: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 8: Organic Solvent Sprayers

Fill a spray bottle with an organic solvent. After each solvent rinse, the equipment should be rinsed with distilled/deionized water and air dried. Amount of solvent will depend on the amount of equipment to decontaminate. Provide a 5-gallon bucket or basin to collect the solvent during the rinsing process.

Solvent rinses may not be required unless organics are a contaminant of concern, and may be eliminated from the station sequence.

Station 9: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 10: Clean Equipment Drop

Lay a clean piece of plastic sheeting over the bottom

plastic layer. This will allow easy removal of the plastic in the event that it becomes dirty. Provide aluminum foil, plastic, or other protective material to wrap clean equipment.

7.2.2 Decontamination Procedures

Station 1: Segregate Equipment Drop

Deposit equipment used on-site (i.e., tools, sampling devices and containers, monitoring instruments radios, clipboards, etc.) on the plastic drop cloth/sheet or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination. Loose leaf sampling data sheets or maps can be placed in plastic zip lock bags if contamination is evident.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

Use high pressure wash on grossly contaminated equipment. Do not use high-pressure wash on sensitive or non-waterproof equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Scrub equipment with soap and water using bottle and bristle brushes. Only sensitive equipment (i.e., radios, air monitoring and sampling equipment) which is waterproof should be washed. Equipment which is not waterproof should have plastic bags removed and wiped down with a damp cloth. Acids and organic rinses may also ruin sensitive equipment. Consult the manufacturers for recommended decontamination solutions.

Station 4: Equipment Rinse

Wash soap off of equipment with water by immersing the equipment in the water while brushing. Repeat as many times as necessary.

Station 5: Low-Pressure Rinse

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 6: Nitric Acid Sprayers (required only if metals are a contaminant of concern)

Using a spray bottle rinse sampling equipment with nitric acid. Begin spraying (inside and outside) at one end of the equipment allowing the acid to drip to the other end into a 5-gallon bucket. A rinsate blank may be required at this station. Refer to Section 9.

Station 7: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 8: Organic Solvent Sprayers

Rinse sampling equipment with a solvent. Begin spraying (inside and outside) at one end of the equipment allowing the solvent to drip to the other end into a 5-gallon bucket. Allow the solvent to evaporate from the equipment before going to the next station. A QC rinsate sample may be required at this station.

Station 9: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure washer.

Station 10: Clean Equipment Drop

Lay clean equipment on plastic sheeting. Once air dried, wrap sampling equipment with aluminum foil, plastic, or other protective material.

7.2.3 Post Decontamination Procedures

1. Collect high-pressure pad and heavy equipment decontamination area liquid and waste and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the Department of Transportation (DOT) requirements for appropriate containers based on the contaminant of concern.
2. Collect high-pressure pad and heavy equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
3. Empty soap and water liquid wastes from basins and buckets and store in appropriate

drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

4. Empty acid rinse waste and place in appropriate container or neutralize with a base and place in appropriate drum. pH paper or an equivalent pH test is required for neutralization. Consult DOT requirements for appropriate drum for acid rinse waste.
5. Empty solvent rinse sprayer and solvent waste into an appropriate container. Consult DOT requirements for appropriate drum for solvent rinse waste.
6. Using low-pressure sprayers, rinse basins, and brushes. Place liquid generated from this process into the wash water rinse container.
7. Empty low-pressure sprayer water onto the ground.
8. Place all solid waste materials generated from the decontamination area (i.e., gloves and plastic sheeting, etc.) in an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
9. Write appropriate labels for waste and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum generated from the decontamination process.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

A rinsate blank is one specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field.

Rinsate blanks are samples obtained by running analyte free water over decontaminated sampling

equipment to test for residual contamination. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identical to samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Where dedicated sampling equipment is not utilized, collect one rinsate blank per day per type of sampling device samples to meet QA2 and QA3 objectives.

If sampling equipment requires the use of plastic tubing it should be disposed of as contaminated and replaced with clean tubing before additional sampling occurs.

10.0 DATA VALIDATION

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the project's data quality objectives.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow OSHA, U.S. EPA, corporate, and other applicable health and safety procedures.

Decontamination can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before use. Decontamination materials may degrade protective clothing or equipment; some solvents can permeate protective clothing. If decontamination materials do pose a health hazard, measures should be taken to protect personnel or substitutions should be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process.

Safety considerations should be addressed when using abrasive and non-abrasive decontamination

equipment. Maximum air pressure produced by abrasive equipment could cause physical injury. Displaced material requires control mechanisms.

Material generated from decontamination activities requires proper handling, storage, and disposal. Personal Protective Equipment may be required for these activities.

Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e., acetone, alcohol, and trisodiumphosphate).

In some jurisdictions, phosphate containing detergents (i.e., TSP) are banned.

12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, February, 1988.

A Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February, 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October, 1985.

APPENDIX A

Table

Table 1. Soluble Contaminants and Recommended Solvent Rinse

TABLE 1 Soluble Contaminants and Recommended Solvent Rinse		
SOLVENT ⁽¹⁾	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Tap water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Nitric acid Acetic acid Boric acid	Basic (caustic) compounds (e.g., amines and hydrazines)
Dilute Bases	Sodium bicarbonate (e.g., soap detergent)	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents ⁽²⁾	Alcohols Ethers Ketones Aromatics Straight chain alkalines (e.g., hexane) Common petroleum products (e.g., fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent ⁽²⁾	Hexane	PCBs

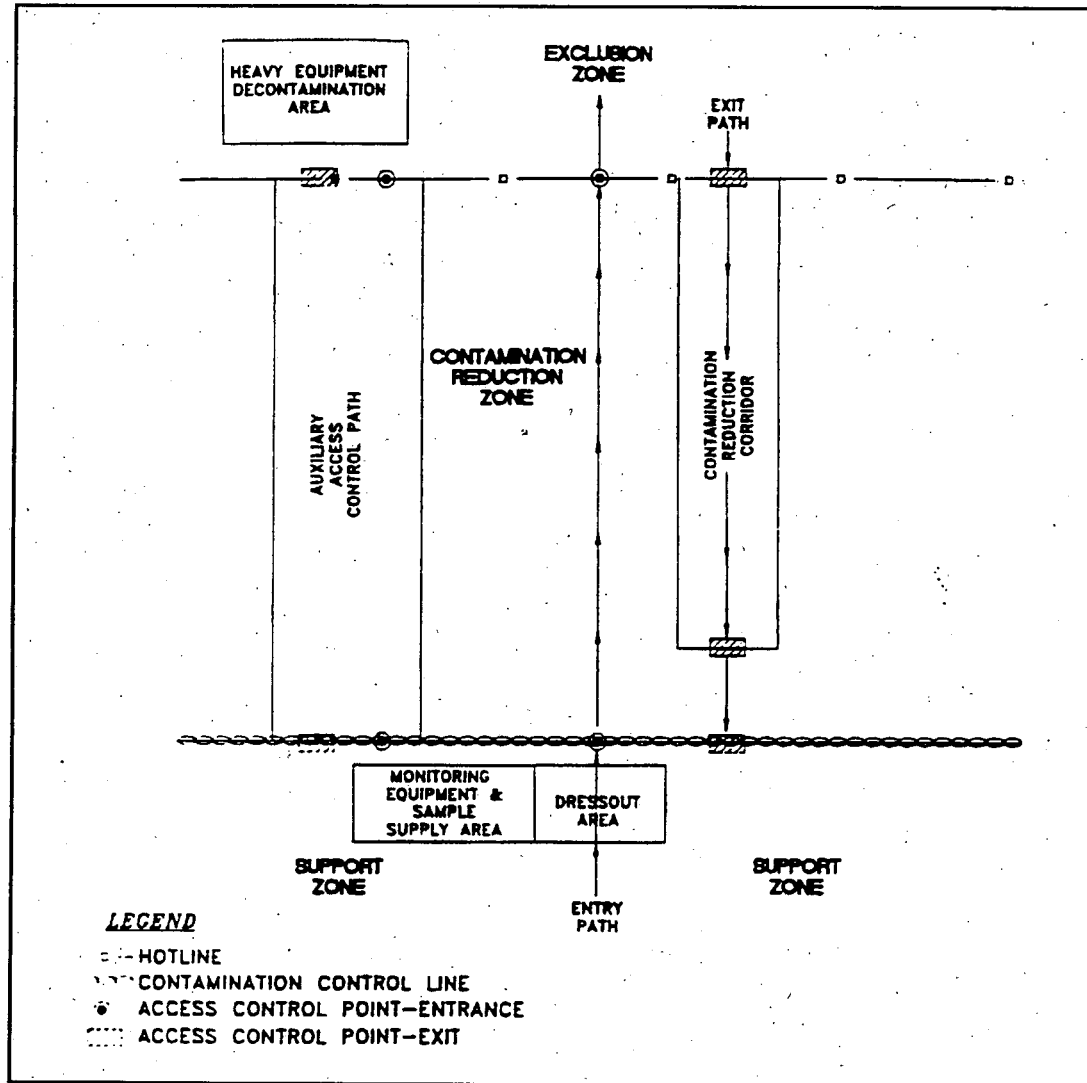
⁽¹⁾ - Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

⁽²⁾ - WARNING: Some organic solvents can permeate and/or degrade the protective clothing

APPENDIX B

Figures

Figure 1. Contamination Reduction Zone Layout



APPENDIX B (Cont'd.)

Figures

Figure 2. Decontamination Layout

